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A users manual for the Naval Postgraduate School aircraft synthesis program

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THESIS

A USERS MANUAL FOR THE
NAVAL POSTGRADUATE SCHOOL
AIRCRAFT SYNTHESIS PROGRAM

by

John T. Parker

September, 1991

Thesis Advisor: Conrad F. Newberry

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Included in the thesis are four examples that demonstrate some of the capabilities of ACSYNT and the use of CREATE.

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A Users Manual for the
Naval Postgraduate School
Aircraft Synthesis Program

by

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Submitted in partial fulfillment
of the requirements for the degree of

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ABSTRACT

A menu-driven computer program has been developed to serve as a users interface with ACSYNT, the NASA-AMES program for aircraft synthesis. The interface program, CREATE, drastically reduces the amount of time required to learn how to use ACSYNT, thus allowing the power of ACSYNT to be used more effectively by the Aircraft Design curriculum at the Naval Postgraduate School.

CREATE has been developed to reduce the required number of inputs to ACSYNT and is ideal for use with the early phases of the Aeronautical Engineering Curriculum. It can provide rapid feedback when examining the effects that different aircraft parameters have on the overall aircraft performance, thus enhancing the students understanding of the relationships between the numerous variables of aircraft studies.

Included in the thesis are four examples that demonstrate some of the capabilities of ACSYNT and the use of CREATE.

TABLE OF CONTENTS

I. INTRODUCTION

A. THESIS ORIENTATION

This thesis is designed to serve as a users manual for use with the Naval Postgraduate School Aircraft Synthesis Program (NPSASP). NPSASP consists of two parts: ACSYNT and CREATE. ACSYNT (Aircraft Synthesis) is briefly described in section (B) below. CREATE was developed for this thesis and is described in detail in the following chapters. Additionally, one of the modules of ACSYNT, NAVY, was extensively modified and reinstalled at NPS as thesis work (Chapter IX).

The information contained in this thesis is entirely based on the version of ACSYNT presently installed on the NPS Aeronautics Department Vax Computer System. Different versions of ACSYNT may or may not be compatible with CREATE.

Included in this thesis are four detailed examples to be used with CREATE. They provide the user with specific guidance on the development of an aircraft data file and interpretation of the results.

B. ACSYNT OVERVIEW

ACSYNT was first developed at the NASA-AMES Research Center during the early 1970's to aid in the conceptual design process of advanced aircraft.

The aircraft type may be transport, bomber or fighter configurations and the size of the aircraft is normally not a factor. Small, unmanned air vehicles (Example 4) as well as transports the size of the C-5 may be evaluated with ACSYNT. Studies have shown that with proper inputs, ACSYNT results match, to within ten percent, the characteristics of existing aircraft [Ref 1]. Many commercial aircraft companies as well as numerous educational institutions use ACSYNT for aircraft design studies.

The Naval Postgraduate School (NPS) played a role in the early evaluation and use of ACSYNT. The application of ACSYNT to VSTOL aircraft was investigated by O'Donnell in 1978 [Ref 1] and the first manual for ACSYNT was written as thesis work by Arnold B. Bruflat [Ref 2] in 1977. The Navy module of ACSYNT was developed at NPS by M. D. Barrett for use in the study of a carrier based, high energy laser equipped aircraft.

Over the years, ACSYNT has evolved as additional capabilities were added and obsolete routines were updated. The modular design of ACSYNT makes it possible to update one module without needing to make extensive modifications to the other modules. While this slow growth has aided the abilities of ACSYNT, it has not made it easier to use. A learning period on the order of weeks is required to fully understand and use the program, thus putting it effectively out of reach for many students. CREATE was developed in an effort to bypass this learning period and bring ACSYNT under control. Specific information about ACSYNT can be found in References 2 and 3.

C. SUGGESTED READING METHOD

When using this thesis as a users manual, Chapters I and II should be read first to gain an insight into the nature of NPSASP, after which Examples 1, 2 and 3 should be performed. Chapters III - VIII should be used as reference material when establishing a new design or when performing one of the Examples. Example 4 provides additional experience with an oblique wing, unmanned air vehicle, to demonstrate the lower weight range that ACSYNT can handle.

II. CREATE OVERVIEW

A. PROGRAM PHILOSOPHY

The primary goal for CREATE is to assist a novice user to build and edit the aircraft data file that is used by ACSYNT to analyze a design. While this data file could be produced manually, it is not a simple matter and would act as another obstacle for a novice to overcome. A "professional" user of ACSYNT may want to bypass CREATE and build/edit the data file manually, as CREATE does not support some of the advanced features of ACSYNT.

The second goal for CREATE is to minimize the probability that a data file will be rejected by ACSYNT. CREATE incorporates numerous error-trapping routines that will help to catch problems before running ACSYNT, and additionally insures that many of the undocumented idiosyncracies of ACSYNT are satisfied. It should be noted that ACSYNT is still a very sensitive program and "crashes" often occur, even for what appears to be a valid set of aircraft parameters. Computations internal to ACSYNT are not always protected from common calculation errors, such as dividing by zero.

CREATE is a "mirror" image of ACSYNT. Each section of CREATE (Geometry, Trajectory, etc...) is directly linked to the corresponding module of ACSYNT. The information discussed in the following Chapters applies to both ACSYNT and CREATE.

B. PROGRAM STRUCTURE

CREATE has two main paths that it will follow when building or editing a data file (see source code listing in Appendix A). The first path is used when a new file is created. When this path is initiated, all of the default variables are set and internal flags are raised. These flags ensure that the user is guided through each of the required or selected modules in the correct sequence. The second path is enabled when a previously created file is loaded. This allows the user to bypass modules that do not need to be altered, thus saving time. The flow chart for CREATE is shown in Figure 1.

If CREATE senses an error when a variable is input, that value will not be accepted. This will occur if the variable is outside of the recommended range or it is not of the correct data type (real, integer or logical). An example of this is attempting to input a real number when an integer is expected. The acceptable range and data type for each variable are given in Chapters III-VIII.

C. CAUTIONARY NOTES

CREATE uses a linear structure, that is it builds the data file as the user progresses through the program. If the user breaks out of the program (via ctrl-c or other means) the data file will be incomplete and unsuitable for use. The entire sequence of CREATE must be completed each and every time the program is accessed.

If a previously created file is being edited, a back-up file, named "TEMP.DAT", is created in the users root directory. This back-up file is an identical copy to the original data file. If a power failure or other catastrophe should occur while editing the original file, this back-up may be renamed to the original and used.

CREATE and ACSYNT use the same logical unit numbers for input and output (I/O) control. If ACSYNT crashes during a run, the following commands should be executed before running CREATE again:

- DEASSIGN FOR005
- DEASSIGN FOR006
- DEASSIGN FOR007
- DEASSIGN FOR010

If these commands are not executed, create will attempt to use the same I/O paths that ACSYNT was using, with fatal results. If ACSYNT does not crash, these commands are executed automatically upon ACSYNT completion.

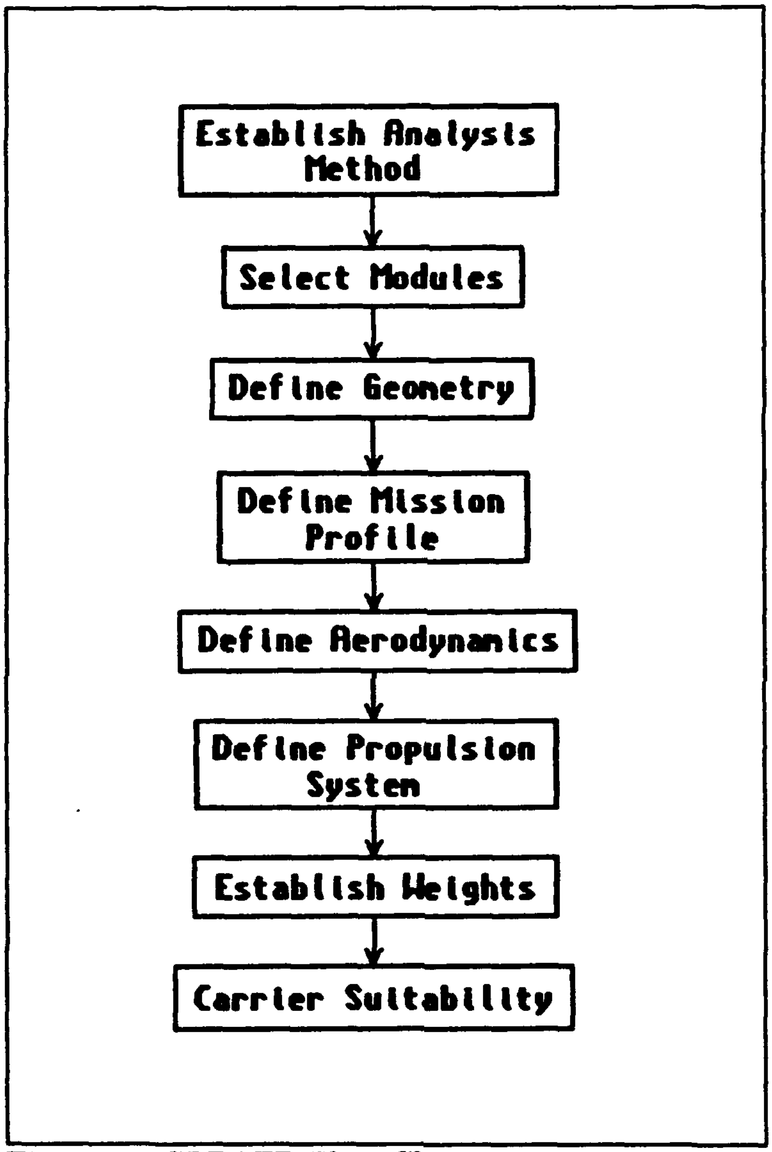


Figure 1. CREATE Flow Chart

III. ANALYSIS METHODS

A. OVERVIEW

Three analysis methods are supported by CREATE: Simple Analysis, Optimization and Sensitivity. Each method is described in detail below. Selection of one of the analysis methods sets the course that ACSYNT will follow when evaluating the design.

B. SIMPLE ANALYSIS

This should always be the first method used on a new design and whenever a variable is changed on an old design. When this method is selected, ACSYNT will "fly" the design through the given mission (Chapter V) several times. After completing the mission once, ACSYNT updates the estimated fuel weight required to fly the mission. This in turn alters the estimated gross weight of the aircraft at takeoff (via the weights module). This new estimate is then used on the next pass through the mission. When the new estimated weight and the weight actually required to fly the mission agree within a tolerance of 0.0001, the aircraft is said to be "converged". To use this method, it only needs to be selected via the Analysis Method Menu with CREATE.

C. OPTIMIZATION ANALYSIS

ACSYNT will optimize one variable (known as the objective variable) given a number of design variables (variables that ACSYNT may modify to optimize the objective) and constraints. The only requirement for this method is that the design variables may not be related to each other (i.e. wing span and aspect ratio should not be used together) and the design must have been previously converged using Simple Analysis. If the design is not yet converged, the Optimization process will be started while ACSYNT is attempting to converge the design. This will cause erroneous Optimization results.

An example of this method would be to minimize the aircraft gross weight by allowing ACSYNT to resize the wing area (within supplied limits), given a constraint on the required turning radius. See Example 3 for further insight into this method.

The variables that may be used with this method are given in Tables 1 - 5. The variables are input to the program by using the Global Variable Number that is assigned to each variable. It should be noted that not every variable used to define a design may be used to optimize the design. Also note that the units associated with each variable are not always the same units used with the aircraft data file. Typically, performance parameters or gross weight are used as the Objective Variable while geometric or performance parameters are used as the Design Variables. See Reference 4 for specific information on this method.

1. Optimization Inputs

The following information is required for input when running CREATE:

- The Objective Variable and its Global Number.
- The Design Variable(s) and the Global Number(s). Upper and lower bounds must also be provided for each variable.
- The Constraint Variable(s) and the Global Number(s). Upper and lower bounds on the Constraint(s) will also be required. Constraints should only be used if they are required. Unnecessary constraints will only inhibit the Optimization process.

D. SENSITIVITY ANALYSIS

This method is useful to examine the effect that certain variables have on another variable. For example, the effect that the canard aspect ratio has on the turning rate could be examined. This method is used in a manner similar to the Optimization Method. The Sensitivity Objective is the variable that will be examined (e.g. the turning rate). The Sensitivity Variable is the variable that will be altered. Seven different values of the Sensitivity Variable will be analyzed by ACSYNT, scaled between upper and lower bounds as provided by the user. These values will produce seven different outcomes on the Sensitivity Objective (see Example 2). Up to eight sensitivity variables and objectives may be selected.

1. Sensitivity Inputs

The following information is required for input with this method:

- The Sensitivity Objective(s) and the Global Number(s).
- The Sensitivity Variable(s) and the Global Number(s). Upper and lower bounds on each variable must also be provided.

TABLE 1.

Geometry Variables	
Variable	Global Number
1/4 Chord Sweep, Canard (deg)	423
1/4 Chord Sweep, Horizontal Tail (deg)	424
1/4 Chord Sweep, Vertical Tail (deg)	425
1/4 Chord Sweep, Wing (deg)	426
Aspect Ratio, Canard	45
Aspect Ratio, Horizontal Tail	46
Aspect Ratio, Vertical Tail	59
Aspect Ratio, Wing	60
Fuel Fraction in Wing	211
Fuselage Afterbody Fineness Ratio	208
Fuselage Diameter (maximum) (ft)	66
Fuselage Fineness Ratio (overall)	209
Fuselage Length (ft)	69
Fuselage Nose Fineness Ratio	210
Fuselage Volume (ft^3)	525
Mean Aerodynamic Chord, Canard (ft)	70
Mean Aerodynamic Chord, Horizontal Tail (ft)	71
Mean Aerodynamic Chord, Vertical Tail (ft)	72
Mean Aerodynamic Chord, Wing (ft)	73
Number of Crew	182
Number of Vertical Tails	529
Pod Length (ft)	307
Pod Radius (ft)	308
Pod Volume (ft^3)	524

TABLE 1. (cont)

Geometry Variables	
Variable	Global Number
Reference Area, Canard (ft^2)	371
Reference Area, Horizontal Tail (ft^2)	388
Reference Area, Vertical Tail (ft^2)	415
Reference Area, Wing (ft^2)	422
Root Chord, Canard (ft)	367
Root Chord, Horizontal Tail (ft)	368
Root Chord, Vertical Tail (ft)	369
Root Chord, Wing (ft)	370
Root Elevation, Canard (ft)	671
Root Elevation, Horizontal Tail (ft)	669
Root Elevation, Vertical Tail (ft)	670
Root Elevation, Wing (ft)	668
Root LE Location, Canard (ft)	608
Root LE Location, Horizontal Tail (ft)	609
Root LE Location, Vertical Tail (ft)	611
Root LE Location, Wing (ft)	612
Root T/C Ratio, Canard	427
Root T/C Ratio, Horizontal Tail	428
Root T/C Ratio, Vertical Tail	429
Root T/C Ratio, Wing	430
Span, Canard (ft)	411
Span, Horizontal Tail (ft)	412
Span, Vertical Tail (ft)	413
Span, Wing	414

TABLE 1. (cont)

Geometry Variables	
Variable	Global Number
Strake Area, LE (ft^2)	682
Strake Area, TE (ft^2)	685
Strake Sweep, LE (deg)	684
Taper Ratio, Canard	511
Taper Ratio, Horizontal Tail	512
Taper Ratio, Vertical Tail	513
Taper Ratio, Wing	514
Tip T/C Ratio, Canard	431
Tip T/C Ratio, Horizontal Tail	432
Tip T/C Ratio, Vertical Tail	433
Tip T/C Ratio, Wing	434
Wetted Area, Canard (ft^2)	417
Wetted Area of Each Pod (ft^2)	419
Wetted Area, Fuselage (ft^2)	416
Wetted Area, Horizontal Tail (ft^2)	418
Wetted Area of the LE Strake (ft^2)	663
Wetted Area of the TE Strake (ft^2)	664
Wetted Area, Vertical Tail (ft^2)	420
Wetted Area, Wing (ft^2)	421
Wing Dihedral (deg)	667
Wing LE Flap Chord (% of wing chord)	243
Wing TE Flap Chord (% of wing chord)	470

TABLE 2.

Trajectory Variables	
Variable	**Global Number**
Altitude at End of Phase 1	217
Altitude at End of Phase 2	218
Altitude at End of Phase 3	219
Altitude at End of Phase 4	220
Altitude at End of Phase 5	221
Altitude at End of Phase 6	222
Altitude at End of Phase 7	223
Altitude at End of Phase 8	224
Altitude at End of Phase 9	225
Altitude at End of Phase 10	226
Altitude at End of Phase 11	227
Altitude at End of Phase 12	228
Altitude at Start of Phase 1	229
Altitude at Start of Phase 2	230
Altitude at Start of Phase 3	231
Altitude at Start of Phase 4	232
Altitude at Start of Phase 5	233
Altitude at Start of Phase 6	234
Altitude at Start of Phase 7	235
Altitude at Start of Phase 8	236
Altitude at Start of Phase 9	237
Altitude at Start of Phase 10	238
Altitude at Start of Phase 11	239
Altitude at Start of Phase 12	240

TABLE 2. (cont)

Trajectory Variables	
Variable	**Global Number**
Cruise Mach Number	183
Cruise Range (nm)	351
Design Load Factor (g's)	188
Instantaneous Turn Rate, Phase 1 (deg/s)	435
Instantaneous Turn Rate, Phase 2 (deg/s)	436
Instantaneous Turn Rate, Phase 3 (deg/s)	437
Instantaneous Turn Rate, Phase 4 (deg/s)	438
Instantaneous Turn Rate, Phase 5 (deg/s)	439
Instantaneous Turn Rate, Phase 6 (deg/s)	440
Instantaneous Turn Rate, Phase 7 (deg/s)	441
Instantaneous Turn Rate, Phase 8 (deg/s)	442
Instantaneous Turn Rate, Phase 9 (deg/s)	443
Instantaneous Turn Rate, Phase 10 (deg/s)	444
Instantaneous Turn Rate, Phase 11 (deg/s)	445
Instantaneous Turn Rate, Phase 12 (deg/s)	446
Mach Number at End of Phase 1	399
Mach Number at End of Phase 2	400
Mach Number at End of Phase 3	401
Mach Number at End of Phase 4	402
Mach Number at End of Phase 5	403
Mach Number at End of Phase 6	404
Mach Number at End of Phase 7	405
Mach Number at End of Phase 8	406
Mach Number at End of Phase 9	407

TABLE 2. (cont)

Trajectory Variables	
Variables	**Global Number**
Mach Number at End of Phase 10	408
Mach Number at End of Phase 11	409
Mach Number at End of Phase 12	410
Mach Number at Start of Phase 1	245
Mach Number at Start of Phase 2	246
Mach Number at Start of Phase 3	247
Mach Number at Start of Phase 4	248
Mach Number at Start of Phase 5	249
Mach Number at Start of Phase 6	250
Mach Number at Start of Phase 7	251
Mach Number at Start of Phase 8	252
Mach Number at Start of Phase 9	253
Mach Number at Start of Phase 10	254
Mach Number at Start of Phase 11	255
Mach Number at Start of Phase 12	256
Maximum Dynamic Pressure (psi)	338
Specific Excess Power, Phase 1 (ft/s)	312
Specific Excess Power, Phase 2 (ft/s)	313
Specific Excess Power, Phase 3 (ft/s)	314
Specific Excess Power, Phase 4 (ft/s)	315
Specific Excess Power, Phase 5 (ft/s)	316
Specific Excess Power, Phase 6 (ft/s)	317
Specific Excess Power, Phase 7 (ft/s)	318
Specific Excess Power, Phase 8 (ft/s)	319

TABLE 2. (cont)

Trajectory Variables	
Variable	**Global Number**
Specific Excess Power, Phase 9 (ft/s)	320
Specific Excess Power, Phase 10 (ft/s)	321
Specific Excess Power, Phase 11 (ft/s)	322
Specific Excess Power, Phase 12 (ft/s)	323
Sustained Turn Rate, Phase 1 (deg/s)	447
Sustained Turn Rate, Phase 2 (deg/s)	448
Sustained Turn Rate, Phase 3 (deg/s)	449
Sustained Turn Rate, Phase 4 (deg/s)	450
Sustained Turn Rate, Phase 5 (deg/s)	451
Sustained Turn Rate, Phase 6 (deg/s)	452
Sustained Turn Rate, Phase 7 (deg/s)	453
Sustained Turn Rate, Phase 8 (deg/s)	454
Sustained Turn Rate, Phase 9 (deg/s)	455
Sustained Turn Rate, Phase 10 (deg/s)	456
Sustained Turn Rate, Phase 11 (deg/s)	457
Sustained Turn Rate, Phase 12 (deg/s)	458
Taxi and Warm-up Time (min)	497
Takeoff/Land Altitude (ft)	38
Take-off Time (min)	498
Ultimate Load Factor (g's)	519

TABLE 3.

Aerodynamics Variables	
Variable	**Global Number**
Horizontal Tail Lift Curve Slope	708
Wing Lift Curve Slope	707

TABLE 4.

Propulsion Variables	
Variable	**Global Number**
Bypass Ratio	65
Compressor Adiabatic Efficiency	198
Design Fan Pressure Ratio	310
Engine Face Diameter (ft)	189
Fan Adiabatic Efficiency	199
Nozzle Velocity Coefficient	522
Number of Engines	196
Outer Compressor Pressure Ratio	336
Overall Compressor Pressure Ratio	337
Thrust/Weight Ratio at Take-off	516
Turbine Adiabatic Efficiency	200
Turbine Inlet Temperature (deg R)	517

TABLE 5.

Weights Variables	
Variable	**Global Number**
Total Aircraft Weight	**585**
Weight of Ammunition	**535**
Weight of Bombs	**540**
Weight of Missiles	**576**

IV. AIRCRAFT GEOMETRY

A. OVERVIEW

The Geometry Module is used to define the physical dimensions of the proposed aircraft. Inputs are made in nine areas: wing, strakes, horizontal and vertical tails, canards, wing mounted pods, fuselage mounted pods, fuselage, crew station and fuselage tanks. Of these nine, only three (wing, pods and fuselage) are required (either fuselage mounted pods or wing mounted pods must be selected). CREATE will insure that the required items are completed.

B. WING GEOMETRY

Two types of wings may be selected: symmetric or oblique. Variable sweep wings may be entered using the symmetric wing type. The wing planform in either case must be trapezoidal. The available variables are:

- Wing Aspect Ratio (to the aircraft centerline).
  Default: 5.0, Range: (0.0,12.0], Type: Real

- Wing reference area (ft^2). This is the total area of the wing, including the area covered by the fuselage.
  Default: 500.0, Range: > 0.0, Type: Real

- Wing dihedral (in degrees), measured positive up from the horizontal. Negative values refer to anhedral.
  Default: 0.0, Range: [-20.0,20.0], Type: Real

- The fuel density of the wing fuel (in lbs/ft^3) (JP-4 is 48.62)
  Default: 48.62, Range: > 0.0, Type: Real

- Fraction of the wing chord that is covered by leading edge flaps/slats. (0.12 = 12% of the total wing chord consists of leading edge flaps). Enter 0.0 if there are no leading edge devices.
  Default: 0.12, Range: [0.0, 0.5], Type: Real

- Leading edge sweep angle (in degrees) (only for symmetric wing). Input a negative value for a forward sweep.
  Default: 0.0, Range: [-30.0, 60.0], Type: Real

- Wetted area multiplier (how much of the wing is exposed, 1.0 = fully exposed wing).
  Default: 1.0, Range: (0.0, 2.0], Type: Real

- Wing taper ratio.
  Default: 0.99, Range: [0.0, 1.0], Type: Real

- Thickness to chord ratio at the wing root.
  Default: 0.1, Range: [0.02, 0.18], Type: Real

- Thickness to chord ratio at the wing tip.
  Default: 0.1, Range: [0.02, 0.18], Type: Real

- Fraction of the total wing chord that is covered by trailing edge flaps. Trailing edge flaps are assumed to be double-segmented Fowler flaps.
  Default: 0.12, Range: [0.0, 0.5], Type: Real

- Fraction of the available wing volume that will be filled with wing fuel (0.5 = 50% of the wing volume will have fuel in it).
  Default: 1.0, Range: [0.0, 1.0], Type: Real

- Position of the wing quarter chord, given as a fraction of total fuselage length (for a 50' fuselage, wing quarter chord at 20' equates to 20/50=0.4, as measured from the nose).
  Default: 0.5, Range: [0.0, 1.0], Type: Real

- Elevation of the root chord of the wing above the fuselage reference plane, given as a fraction of the maximum fuselage radius.
  0.0 = the wing is mounted on the middle of the fuselage
  1.0 = the wing is mounted on top of the fuselage
  -1.0 = the wing is mounted on the bottom of the fuselage.
  Default: 0.0, Range: [-1.0, 1.0], Type: Real

C. STRAKE GEOMETRY

Leading edge and/or trailing edge strakes may be selected. Strakes are the only method available that will modify the straight leading edge or trailing edge of the wing. If only LE or TE strakes are present, set the values for the strake that is not present to 0.0. If the strakes are not positioned correctly relative to the wing, a non-fatal warning will be printed out. The available variables are:

- Location of the strake leading edge on the fuselage, as a fraction of the total fuselage length measured from the fuselage nose.
  Default: 0.0, Range: [0.0, Wing LE], Type: Real

- Ratio of the leading edge strake span/2 to the wing span/2.
  Default: 0.0, Range: [0.0, 1.0]. Type: Real

- Location of the strake trailing edge as a fraction of the total fuselage length, measured from the fuselage nose.
  Default: 0.0, Range: [Wing LE, 1.0]

- Ratio of the trailing edge strake span/2 to the wing span/2).
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Wetted area multiplier for the strake(s).
  Default: 1.0, Range: [0.0, 2.0], Type: Real

- Strake leading edge bluntness indicator
  0 = sharp leading edge
  1 = blunt leading edge
  Default: 0, Range: 0 or 1, Type: Integer

D. HORIZONTAL AND VERTICAL TAIL GEOMETRY

Only conventional tail surfaces are supported. V-tails or canted vertical stabilizers can not be entered in this version of ACSYNT. While not required, if a vertical tail is not used, ACSYNT will crash during printout of the final summary section. This crash will not affect the aircraft calculations. The available variables are:

- Aspect ratio (to the fuselage centerline).
  Default: 5.0, Range: (0.0, 12], Type: Real

- Reference area (ft^2). If the area is set at 0.0, ACSYNT will size the surface area based on the value for the horizontal tail sizing fraction, if given (Tail area = wing area times the sizing fraction). If the horizontal tail sizing fraction is set to 0.0, the tail will be sized using the volume coefficient.
  Default: 50.0, Range: > 0.0, Type: Real

- Horizontal/Vertical tail volume coefficient. Used only when the horizontal tail sizing fraction is set to 0.0 and the area is input as 0.0.
  Default: 1.0, Range: [0.3, 1.0], Type: Real (<u>Hor. Tail</u>)
  Default: 0.6, Range: [0.01, 0.2], Type: Real (<u>Ver. Tail</u>)

- Horizontal/Vertical tail sizing fraction. If set to 0.0, the horizontal tail is sized using the volume coefficient.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Leading edge sweep (in degrees).
  Default: 0.0, Range: [-9.0, 60.0], Type: Real

- Wetted area multiplier.
  Default: 1.0, Range: [0.0, 2.0], Type: Real

- Taper ratio.
  Default: 0.99, Range: [0.0, 1.0], Type: Real

- Thickness to chord ratio at the root.
  Default: 0.1, Range: [0.02, 0.18], Type: Real

- Thickness to chord ratio at the tip.
  Default: 0.1, Range: [0.02, 0.18], Type: Real

- Location of the trailing edge of the horizontal/vertical tail, as a fraction of the total fuselage length, measured from the nose.
  Default: 1.0, Range: [0.5, 1.0], Type: Real

- Elevation of the horizontal tail on the fuselage.
  -1.0 to 0.99 = horizontal tail is mounted on the fuselage.
  1.0 to 1.99 = horizontal tail is mounted on the vertical tail.
  2.0 = horizontal tail is mounted on top of the vertical tail (T-tail)
  Default: 0.0, Range: [-1.0, 2.0], Type: Real

- Elevation of the root chord of the vertical tail as a fraction of the maximum fuselage radius, measured up from the fuselage reference plane.
  Default: 0.0, Range: [-1.0, 1.0], Type: Real

- Number of vertical tails
  1.0 = one central tail
  2.0 = two symmetric tails
  3.0 = two symmetric tails with 1 central tail
  Default: 1.0, Range: 1.0 or 2.0 or 3.0, Type: Real

- Sizing logic. If equal to true, then the tail(s) will be resized on every ACSYNT iteration. If this is set to false, the input value for the area will be used regardless of the values used for the sizing fraction or the volume coefficient.
  Default: F, Range: T or F, Type: Logical

E. CANARD GEOMETRY

Canards may be used as a control surface or as a third lifting surface.

The available variables are:

- Aspect Ratio.
  Default: 5.0, Range: (0.0, 12.0], Type: Real

- Reference area (ft^2). If this is set to 0.0, the canard will be sized using the canard sizing fraction, if given (Canard area = wing area times sizing fraction). If the canard sizing fraction is 0.0, the canard will be sized using the volume coefficient.
  Default: 50.0, Range: > 0.0, Type: Real

- Canard volume coefficient. (This should be negative since the canards are in front of the wing). Used only if the sizing fraction is 0.0.
  Default: -0.8, Range: [-1.0, 0.0], Type: Real

- Canard sizing fraction. If 0.0 is entered, the canard will be sized using the volume coefficient.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Leading edge sweep (degrees).
  Default: 0.0, Range: [-9.0, 60.0], Type: Real

- Wetted area multiplier.
  Default: 1.0, Range: (0.0, 2.0], Type: Real

- Taper ratio.
  Default: 0.99, Range: [0.0, 1.0], Type: Real

- Thickness to chord ratio at root.
  Default: 0.1, Range: [0.02, 0.18], Type: Real

- Thickness to chord ratio at tip.
  Default: 0.1, Range: [0.02, 0.18], Type: Real

- Location of the leading edge of the canard root chord as a fraction of total fuselage length.
  Default: 0.0, Range: [0.0, 0.5], Type: Real

- Elevation of the canard above the fuselage reference plane as a fraction of maximum fuselage radius.
  1.0 = top mounted canard
  -1.0 = bottom mounted canard
  Default: 0.0, Range: [-1.0, 1.0], Type: Real

- Canard location
  1 = canard on the central body
  2 = canard is outboard of twin nacelles (fuselage inlets)
  Default: 1, Range: 1 or 2, Type: Integer

- Sizing logic. If equal to true, then the canards will be resized on every ACSYNT iteration. If equal to false, the input value for the area will be used.
  Default: F, Range: T or F, Type: Logical

F. WING MOUNTED ENGINE PODS

Either wing pods or fuselage pods must be selected. The number of pods should equal the number of engines on the aircraft. Up to ten pods may be defined. The available variables are:

- Pod Diameter (ft). If set equal to 0.0, the engine diameter will be used.
  Default: 3.0, Range: (0.0, 30.0], Type: Real

- Pod Length (ft). If set to 0.0, the engine length will be used.
  Default: 10.0, Range: (0.0, 40.0], Type: Real

- X location of the nose of the pod relative to the wing leading edge, given as a fraction of the local wing chord. (Fig 2). Negative values indicate that the pod leading edge is ahead of the wing leading edge.
  Default: 0.0, Range: [-1.0, 1.0], Type: Real

- Y location of the center of the pod relative to the fuselage centerline, given as a fraction of the wing semi-span. (Fig 2).
  Default: 0.5, Range: [0.0, 1.0], Type: Real

- Z location of the center of the pod above the wing, as a fraction of maximum pod diameter. (Fig 2). Negative values indicate that the pod center is below the wing.
  Default: -1.0, Range: [-2.0, 2.0], Type: Real

- Wing Pod symmetry code.
  0 = pod has a symmetric image on the other wing
  1 = pod does not have an image
  Default: 0, Range: 0 or 1, Type: Integer

G. FUSELAGE MOUNTED PODS

Either wing mounted pods or fuselage mounted pods must be selected.

The total number of pods must match the number of engines on the aircraft.

Up to 10 pods may be defined. The available variables are:

- Fuselage pod diameter (ft). If set to 0.0, the engine diameter will be used.
  Default: 3.0, Range: (0.0, 30.0], Type: Real

- Fuselage pod length (ft). If set to 0.0, the engine length will be used.
  Default: 10.0, Range: (0.0, 40.0], Type: Real

- Stand-off distance; the distance between the pod wall and the fuselage, given as a fraction of maximum pod radius.
  0.0 = Pod is tangent to the fuselage
  -1.0 = Pod is half-way submerged into the fuselage
  -2.0 = Pod is fully submerged into the fuselage
  Default: 0.1, Range: [-2.0, 3.0], Type: Real

- Angular orientation of pod measured positive up from the horizontal (in degrees) (Fig 3).
  90.0 = 12 O'Clock position
  -90.0 = 6 O'Clock position
  Default: 0.0, Range: [-90.0, 90.0], Type: Real

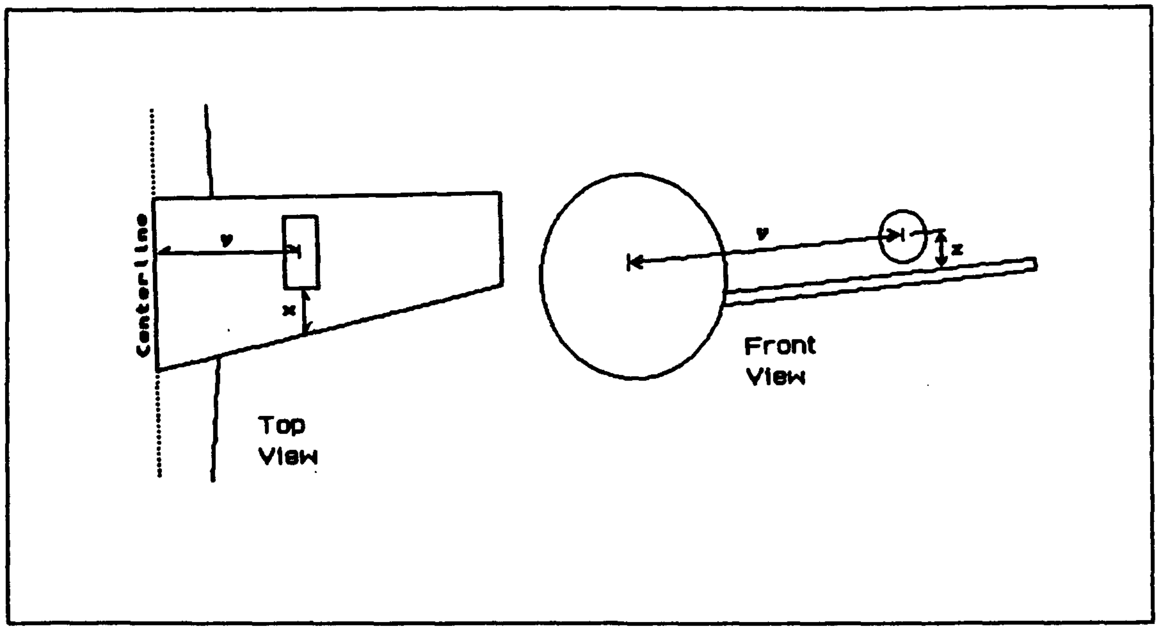


Figure 2. Wing Pod Geometry

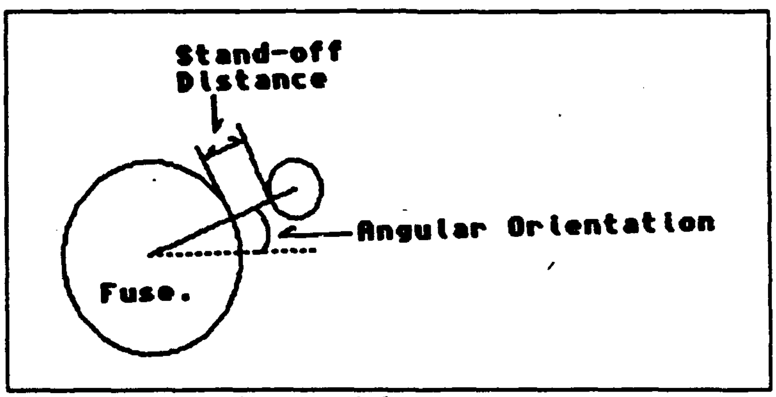


Figure 3. Fuselage Pod Geometry

- X location of the pod nose relative to the nose of the fuselage, given as a fraction of total fuselage length.
  Default: 0.8, Range: [0.0, 1.0], Type: Real

- Fuselage Pod symmetry code.
  0 = Pod has an image on the other side
  1 = Pod does not have an image
  Default: 0, Range: 0 or 1, Type: Real

H. FUSELAGE GEOMETRY

This section is required. ACSYNT models the aircraft fuselage with a cone for the nose and afterbody and a cylinder for the main body. The available variables are:

- Maximum diameter of fuselage (ft).
  Default: 6.0, Range: > 0.0, Type: Real

- Fuselage length (ft).
  Default: 50.0, Range: > 0.0, Type: Real

- Diameter of radar dish located in the nose (ft) (Enter 0.0 if there is no radar).
  Default: 0.0, Range: [0.0, 20.0], Type: Real

- Fineness ratio of the afterbody (length/diameter).
  Default: 2.0, Range: [0.0, 99.99], Type: Real

- Total fuselage fineness ratio (length/diameter) (If 0.0 is entered, ACSYNT will estimate it using fuselage length divided by maximum fuselage diameter).
  Default: 0.0, Range: [0.0, 99.99], Type: Real

- Fineness ratio of the nose (length/diameter). *Note* Small changes in this variable results in significant changes in the gross weight.
  Default: 3.0, Range: [0.0, 99.99], Type: Real

- Length of radar equipment located behind the radar (ft).
  Default: 0.0, Range: [0.0, 30.0], Type: Real

- Surface area complexity factor. The fuselage is modeled by using a cone for the nose and afterbody, and a cylinder for the mid-section. If the surface area will be greater or less than this, it may be altered with this variable.
  1.0 = satisfactory model
  1.1 = add 10% more surface area
  Default: 1.0, Range: [0.0, 2.0], Type: Real

- Fuselage wall thickness (ft) (For transports only).
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- An estimate of the fuel weight required for the mission. This will be the first estimate that ACSYNT uses to fly the mission.
  Default: 5000.0, Range: [0.0, 9000000.00], Type: Real

- Tail indicator.
  0 = standard engine nozzle at rear of fuselage
  1 = fuselage tapers down without a nozzle
  Default: 0, Range: 0 or 1, Type: Integer

I. CREW STATION

This is used only to document the existence of a cockpit. It will not affect the fuselage dimensions. The available variables are:

- Length of crew compartment (ft). If 0.0 is entered, ACSYNT will attempt to size it.
  Default: 0.0, Range: [0.0, 30.0], Type: Real

- Width of crew compartment (ft). 0.0 may also be used here.
  Default: 0.0, Range: [0.0, 20.0], Type: Real

- Number of crew members.
  Default: 2, Range: [0, 6], Type: Integer

- Seating arrangement
  T = Tandem
  F = 2 abreast seating.
  Default: F, Range: T or F, Type: Logical

J. FUSELAGE FUEL TANKS

One or two fuselage fuel tanks may be specified. If two tanks are desired, the fuselage fuel load will be split equally between the two tanks. There is only one input:

- Fuel Density (lbs/ft^3). JP-4 represents the default value.
  Default: 48.62, Range: > 0.0, Type: Real

V. TRAJECTORY MODULE

A. OVERVIEW

The Trajectory Module is used to define a mission for the aircraft. It serves as the cornerstone for the design, in that the converged aircraft is optimized to the input mission. Different missions may or may not be satisfied by the converged design.

Up to twelve legs may be defined for a given mission, using six different types of legs: climb, cruise, acceleration, combat, descent and loiter. Any number of these six leg types may be used to define a mission. It is not necessary to use a strictly logical profile. A mission may consist only of a cruise leg, if so desired, without any climbs or descents. A typical profile is shown in Table 6. Weapons (bombs, ammunition or missiles) may be dropped only during a combat phase. If weapons are to be dropped, the weight and drag of the ordnance is removed from the aircraft at the termination of the combat phase.

This is the most error prone part of ACSYNT. Both fatal and non-fatal errors alike occur during the execution of the Trajectory Module, but these errors are not always caused by the Trajectory module. Many calls are made

to the Propulsion and Aerodynamics modules from the Trajectory module and errors often are caused by these two modules.

The inputs to this module are broken up into two parts. The first part consists of three menus for entering variables. The second part is used for entering the mission profile. A detailed description of the Trajectory module of ACSYNT can be found in Reference 5.

B. TRAJECTORY VARIABLES

The following variables are required for input:

- Cruise Mach number.
  Default: 0.8, Range: (0.0, 3.0], Type: Real
- Design load factor (g's).
  Default: 3.0, Range: [1.0, 12.0], Type: Real
- Ultimate load factor (g's).
  Default: 4.5, Range: [1.0, 15.0], Type: Real
- Takeoff obstacle requirement
  0 = military aircraft (50 ft clearance)
  1 = civilian aircraft (35 ft clearance)
  Default: 0, Range: 0 or 1, Type: Real
- Fuel reserve, as a fraction of total fuel.
  Default: 0.05, Range: [0.0, 0.1], Type: Real
- Estimated endurance Mach number.
  Default: 0.5, Range: [0.0, 2.0], Type: Real
- Maximum dynamic pressure, q (lbs/ft^2).
  Default: 700.0, Range: > 0.0, Type: Real

- Aircraft range (nm).
  Default: 1000.0, Range: > 0.0, Type: Real

- Time spent during warm-up and taxi (min).
  Default: 5.0, Range: > 0.0, Type: Real

- Power setting during warm-up and taxi
  1 = max afterburner
  2 = military power
  3 = maximum continuous power
  4 = thrust equals drag
  5 = idle
  Default: 5, Range: [1, 5], Type: Integer

- Time spent during take-off (min).
  Default: 1.0, Range: > 0.0, Type: Real

- Power setting during take-off (same as above).
  Default: 2, Range: [1, 5], Type: Integer

- Breguet altitude search indicator (used during cruise and climb phases of the mission profile. If selected, ACSYNT will attempt to find the optimum cruise altitude).
  0 = no search
  1 = search for optimum altitude
  Default: 0, Range: 0 or 1, Type: Integer

- Loiter altitude search indicator (used during loiter phases). If selected, ACSYNT will attempt to find the optimum loiter altitude.
  0 = no search
  1 = search for loiter altitude
  Default: 0, Range: 0 or 1, Type: Integer

- Estimate of total internal fuel weight (lbs).
  Default: 5000.0, Range: (0.0, 999999.0], Type: Real

- Amount of external fuel (drop tanks) (lbs).
  Default: 0.0, Range: [0.0, 99999.0]

- Weight of trapped fuel (this is the weight of any unusable fuel) (lbs).
  Default: 100.0, Range: 0.0, 1000.0], Type: Real

- Engine sizing flag. Used in conjunction with the Propulsion Module. The engine will only be sized if the engine weight, length and diameter are all input as 0.0 in the Propulsion module.
  0 = engine sized for thrust/weight at take-off, no AB
  -1 = engine sized for thrust/weight at take-off with AB
  -2 = engine sized for a given thrust with AB
  -3 = engine sized for a given thrust, no AB
  Default: -3, Range: [-3, 0], Type: Integer

- Number of trajectory cruise phases (see below).
  Default: 2, Range: [0, 12], Type: Integer

- Total number of trajectory phases (see below).
  Default: 1, Range: [0, 12], Type: Integer

- Debug print option.
  0 = No Debug
  1 = Debug
  Default: 0, Range: 0 or 1, Type: Integer

C. MISSION PROFILE

Information that is required to define a mission includes the phase starting and ending Mach number, starting and ending altitude (ft), the distance traveled (nm), the time used during that phase (min), the g loading (for a combat phase) and the power setting for that phase. A sample mission is shown in Table 6 below. Note that the climb and descent phases do not use the Mach number, distance or time blocks. Only the starting and ending altitudes are required. It is also permissable to skip a climb or descent phase and input another cruise phase with a new altitude. The distance covered during a climb or descent phase (the distance is computed internally) is not

subtracted from a following cruise phase. The distance block for the loiter phase represents the loiter radius.

TABLE 6. Sample Mission Profile

Phase	Mach Start	Mach End	Alt Start	Alt End	Horiz Dist	Horiz Time	Power Setting
Climb	0.00	0.00	100	20000	0.0	0.0	3
Cruise	0.80	0.80	20000	20000	480	60.0	4
Cruise	0.70	0.70	200	200	210	30.0	4
Accel	0.70	0.90	200	200	0.0	1.0	2
Combat	0.90	0.90	200	200	0	4.0	2
Cruise	0.70	0.70	200	-1	210	30.0	4
Climb	0.00	0.00	200	20000	0.0	0.0	3
Descent	0.00	0.00	20000	500	0.0	0.0	5
Loiter	0.20	0.20	5000	5000	10.0	20.0	4

As fuel is burned during a cruise phase, the aircraft will climb as the weight is burned off. To prevent this, a "-1" should be entered as an ending altitude (note that this is an integer value). This forces the ending altitude to match the starting altitude.

During combat phases, an option is given to input the sustained g loading. If the design cannot sustain the input value, ACSYNT will reduce it until it can be sustained ($P_s = 0.0$).

The "power setting" options are:

- 1 = maximum afterburner
  2 = military power
  3 = maximum continuous
  4 = thrust equals drag
  5 = idle

VI. AERODYNAMICS MODULE

A. OVERVIEW

The Aerodynamics module will determine the aircraft drag, induced drag and lift as a function of the angle of attack. The aircraft minimum drag is calculated through component build-up. The drag for individual components is determined and then summed to determine the total drag at a given Mach number. The total drag consists of: friction drag, wave drag, leading edge bluntness drag, external stores drag, weapons and bomb drag, engine cowl drag, engine boat-tail drag and interference drag [Ref 2:p. 131]. Detailed information about the aerodynamic methods may be found in Reference 4. The code has been validated up to Mach 3.0 by NASA-AMES.

B. AERODYNAMICS INPUT

CREATE uses 8 separate pages to input the aerodynamic characteristics of the design. The available variables are:

- Ratio of body base area to maximum body cross-section. This term is used to account for separation drag on the rear of the body. The base area is any rearward-facing blunt surface.
  Default: 0.15, Range: [0.0, 0.5], Type: Real
- Angle of attack at which C_L max occurs (deg)
  Default: 35.0, Range: (0.0, 60.0], Type: Real

- Maximum angle of attack for subsonic compressibility or interference (deg).
  Default: 40.0, Range: (0.0, 60.0], Type: Real

- Width of the fuselage at the canards (if used) or of the nose. Used in calculating the fuselage pitching moment contribution.
  Default: max fuselage diameter, Range: > 0.0, Type: Real

- Boat-tail exposure factor (for use with pods). If 4 pods were defined but 2 of them are half buried in the fuselage then the boat-tail exposure factor is 0.75. (Number of exposed pods/total number of pods).
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- C_L max scaling factor for clean aircraft.
  Default: 1.0, Range: > 0.0, Type: Real

- Laminar-Turbulent skin friction weighting factor.
  0.0 = All laminar flow
  1.0 = All turbulent flow
  Default: 1.0, Range: [0.0, 1.0], Type: Real

- Reference Mach number array. Used with the following 5 variables. This is an array of up to 10 numbers. Each of the following 5 variables must have the same number of values (i.e. if enter 7 numbers are input here, 7 numbers should be input for the other variables). The terms in the array correspond 1 to 1 with the terms in the 5 following arrays. See the examples section for additional insight.
  Default: 0.0, Range: [0.0, 3.0], Type: Real

- C_L at zero angle of attack for the fuselage. This is an array of up to 10 values that corresponds 1:1 with the reference Mach number array above.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Canard C_L at zero angle of attack. This is an array of up to 10 values that corresponds 1:1 with the reference Mach number array above.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Wing C_L at zero angle of attack. This is an array of up to 10 values that corresponds 1:1 with the reference Mach number array above.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Wing zero-lift pitching moment. This is an array of up to 10 values that corresponds 1:1 with the reference Mach number array above.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Sweep angles for a variable sweep wing (deg). This is an array of up to 10 values that corresponds 1:1 with the reference Mach number array above. These values are not used if the normal Mach number calculation code (below) is set to 0.
  Default: 0.0, Range; [0.0, 60.0], Type: Real

- Variable sweep wing flag.
  T = Wing is variable sweep/oblique
  F = Wing is not variable sweep
  Default: F, Range: T or F, Type: Logical

- Normal Mach number calculation code. (swept/oblique wings)
  0 = Acsynt will sweep the wing to keep the normal component of the Mach number constant at all times.
  1 = Do not calculate the normal component.
  Default: 1, Range: 0 or 1, Type: Real

- Desired normal component of the Mach number. Used only if the normal Mach number calculation code above is set to 0.
  Default: 0.75, Range: (0.0, 3.0], Type: Real

- Maximum wing sweep for the normal Mach number calculations. Used only if the normal Mach number calculation code above is set to 0.
  Default: 60.0, Range: [0.0, 60.0], Type: Real

- Minimum wing sweep for the normal Mach number calculations. Used only if the normal Mach number calculation code above is set to 0.
  Default: 0.0, Range: [0.0, 60.0], Type: Real

- Wing airfoil section code.
  1 = Sharp or near sharp airfoils
  2 = 230-XX and 00-XX airfoils
  3 = 6-series airfoil
  4 = Whitcomb supercritical airfoil
  5 = Leading edge radius to chord ratio specified
  ** If the aspect ratio is less than 1.75, this code is ignored and low-aspect ratio theory is used. Only code 1 gives a smooth drag polar. Other codes may have breaks in the drag polars at high angles of attack and in

transonic regions
Default: 1, Range: [1, 5], Type: Integer

- Leading edge radius to chord ratio, used with code 5 above.
  Default: 0.02, Range: [0.0, 0.5], Type: Real

- Canard airfoil section code. Same as the wing airfoil section codes above.

- Canard leading edge radius to chord ratio, used with canard airfoil section code 5.
  Default: 0.02, Range: [0.0, 0.5], Type: Real

- Distance between the outsides of the twin nacelles, for canard placement (if applicable).
  Default: 0.0, Range: >= 0.0, Type: Real

- Supercritical wing flag.
  1 = Wing is supercritical
  0 = Wing is not supercritical
  Default: 0, Range: 0 or 1, Type: Integer

- Body cross-section code.
  0 = Circular body
  1 = Trapezoidal body
  Default: 0, Range: 0 or 1, Type: Real

- Cowl exposure factor. Used in the same manner as the boat-tail exposure factor.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Friction drag multiplying factor. 1.0 = standard roughness.
  Default: 1.0, Range: [0.0, 2.0], Type: Real

- Canard angle of incidence (used for trim drag) (deg).
  Default: 0.0, Range: 0.0, 10.0], Type: Real

- Average chord of flaps (ft)
  Default: 0.0, Range: > 0.0, Type: Real

- Total area of both wing flaps (ft^2)
  Default: 0.0, Range: > 0.0, Type: Real

- Total span of flaps to be used for aircraft trimming (ft) (used for tailless aircraft)
  Default: 0.0, Range: > 0.0, Type: Real

- Desired location of the CG, given as a fraction of wing chord.
  Default: 0.25, Range: [0.0, 1.0], Type: Real

- Static margin for the CG placement. This is the allowable range that the CG may be varied.
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Height of CG above the fuselage centerline (ft)
  Default: 0.0, Range: > 0.0, Type: Real

- Horizontal tail angle of incidence (deg).
  Default: 0.0, Range: [0.0, 10.0], Type: Real

- Mach numbers for detailed aerodynamic output, maximum of 10 in array format. Corresponds 1:1 with the altitude and C_L arrays below.
  Default: 0.0, Range: [0.0, 3.0], Type: Real

- Altitudes for detailed aerodynamics output (ft), maximum of 10.
  Default: 0.0, Range: [0.0, 99999.0], Type: Real

- Lift coefficients for detailed output, maximum of 10.
  Default: 0.0, Range: [0.0, 8.0], Type: Real

- Total drag due to external bombs (ft^2)
  Default: 0.0, Range: > 0.0, Type: Real

- Total drag due to external stores (ft^2)
  Default: 0.0, Range: > 0.0, Type: Real

- Total drag due to drop tanks (ft^2)
  Default: 0.0, Range: > 0.0, Type: Real

- Total drag due to additional items (ft^2). If the NAVY module is being called, enter the gear down drag here.
  Default: 0.0, Range: > 0.0, Type: Real

- C_L max to be used during landing. If -1.0 is entered, ACSYNT will compute this.
  Default: -1.0, Range: -1.0 or [0.0, 10.0], Type: Real

- C_L max to be used for take-off. -1.0 may be entered here also.
  Default: -1.0, Range: -1.0 or [0.0, 10.0], Type: Real

- Trailing edge flap angle for landing (deg).
  Default: 45.0, Range: [0.0, 60.0], Type: Real

- Trailing edge flap angle for take-off (deg).
  Default: 45.0, Range: [0.0, 60.0], Type: Real

- Leading edge slat angle for landing (deg).
  Default: 30.0, Range: [0.0, 60.0], Type: Real

- Leading edge slat angle for take-off (deg).
  Default: 30.0, Range: [0.0, 60.0], Type: Real

- Lift to drag ratio for landing. -1.0 may be entered to let ACSYNT compute this.
  Default: -1.0, Range: -1.0 or > 0.0, Type: Real

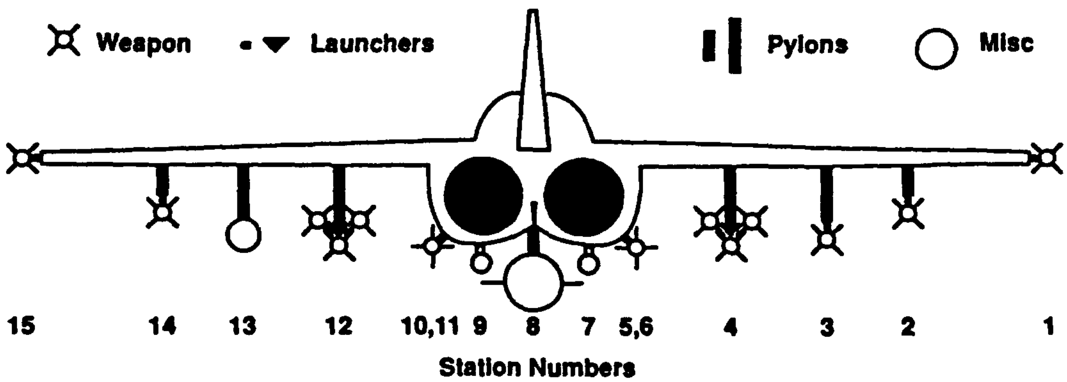
- Lift to drag ratio for take-off. -1.0 may be entered.
  Default: -1.0, Range: -1.0 or > 0.0, Type: Real

C. STORES DRAG COMPUTATION

Figure 4 is an example of an external stores drag computation for ACSYNT. Fifteen stations are being loaded with a variety of weapons. D/q is the drag value associated with each weapon or launcher from Table 7. Tip mounted missiles are assumed to create no drag because they reduce the induced drag for the wing. The mount modification is 1.0 unless it is a corner mount, and then it is 0.8. When weapons are mounted in tandem the draft

modification is set to 0.8 to account for the drafting effect. This example (Figure 4) and Table 7 are taken in their entirety from Reference 3.

Example Store Drag Determination



Station	Load	D/q (1) x	Mount Mod x	Draft Mod x	Number	= ΣD/q (N)
1,15	AIM-9	•			(2)	•
	LAU-114	•			(2)	•
2,14	AIM-120	0.195			(2)	0.390
	LAU-106	0.150		*Tandem*	(2)	0.300
	Short Pylon	0.200		*Carriage*	(2)	0.400
3	AGM-65	0.330	*Corner*		(1)	0.330
	LAU-117	0.200	*Tangent*		(1)	0.200
	Heavy Pylon	0.420	*Mount*		(1)	0.420
4,12	MK-82R	0.220		0.80	(12)	2.112
	MER-10	0.850			(2)	1.700
	Heavy Pylon	0.420			(2)	0.840
5,6,10,11	AIM-7	0.225	0.80	0.80	(4)	0.576
	LAU-106	0.150	0.80	0.80	(4)	0.384
8	600 Gal Tank	0.900			(1)	0.900
	Heavy Pylon	0.420			(1)	0.420
7,9	ALQ-71	0.200			(1)	0.200
13	LANTIRN	1.660			(1)	1.660
	Heavy Pylon	0.420			(1)	0.420

Drag area = 11.25 ft^^2

Figure 4. Example Stores Drag Problem [Ref 3]

TABLE 7. Stores Drag Values [Ref 3]

Component	Notes	Rack Required	Dia	Len	L/D	Weight	D/q
			(in)	(in)		(lb)	(FT^2)
Air to Air							
AIM-9J	Sidewinder	LAU-114, 128	5.0	120.0	24.0	172.0	0.144
AIM-9L	Sidewinder	LAU-114, 128	5.0	120.0	24.0	199.0	0.144
AIM-40D			6.0	79.3	13.2	134.0	0.170
AIM-40B, E, J			6.0	79.3	13.2	164.0	0.170
AIM-120	AMRAAM	LAU-128, 106	7.0	141.0	20.1	333.0	0.195
AIM-7D	Sparrow	LAU-106	8.0	144.0	18.0	402.0	0.225
AIM-7F	Sparrow	LAU-106	8.0	144.0	18.0	510.0	0.225
AIM-54	Phoenix		15.0	156.0	10.4	987.0	0.460
Air to Ground							
AGM-12B	MK 83		12.5	126.0	10.1	580.0	0.300
AGM-12C	Bull Pup		17.3	160.0	9.2	1779.0	0.480
AGM-12E	Bull Pup		17.3	160.0	9.2	1714.0	0.480
AGM-45	Shrike	LAU-34A	8.0	120.0	15.0	406.0	0.220
AGM-62A	Walleye		15.0	136.0	9.1	1108.0	0.410
AGM-84	Harpoon	MAU-12	13.5	152.5	11.3	1142.0	0.450
AGM-65	Maverick	LAU-117, 88	12.0	97.7	8.1	462.0	0.330
AGM-65E	Maverick	LAU-117(1), 88(3)	12.0	97.7	8.1	634.0	0.330
AGM-88A	HARM	LAU-118A	10.0	164.0	16.4	778.0	0.350
Guided Bombs							
GBU-8/B	MK 84		18.0	149.0	8.3	2293.0	0.720
GBU-10/B	Laser MK 84		18.0	168.0	9.3	2053.0	0.720
GBU-24	Electro Optical MK 84		18.0	168.0	9.3	2320.0	0.760
GBU-12/B	MK 82		10.8	126.0	11.7	610.0	0.310
GBU-22	Laser MK 82		10.8	137.0	12.7	705.0	0.310
GBU-11/B			24.1	165.0	6.8	3065.0	0.820
KMU-431/B			14.0	152.0	10.8	1088.0	0.370
GBU-15 CWW			20.3	154.0	7.6	Fig 2-10	1.230
GBU-15 PWW			20.3	154.0	7.6	Fig 2-10	1.300
GBU-15 Data Pod			20.0	130.0	6.5	450.0	0.320
Cluster Bombs	CBU=SUU+BLU						
SUU-25A, B, C	Dispenser		14.0	93.0	6.6	360.0	0.380
SUU-40, 44			14.0	101.0	7.2	365.0	0.350
SUU-20/A			15.6	122.0	7.8	451.0	0.330
SUU-64, 65, 66	TMD, CBU 87/B		15.6	92.0	5.9	Fig 2-8	0.420
SUU-36A, 38A			15.9	141.0	8.9		0.240
SUU-30H-B	CBU 58/B, 52B/B, 71/B		16.1	92.0	5.7	Fig 2-8	0.500
SUU-30B-B	CBU 52/B, 53B/B, 54/B		16.1	92.0	5.7	Fig 2-8	0.410
SUU-41B/A			16.5	140.0	8.5		0.330
SUU-21			17.0	156.0	9.2	620.0	0.320
SUU-42			25.8	140.0	5.4	821.0	0.650
BL755			16.5	96.0	5.8	610.0	0.380
VJ291			16.0	92.0	5.8	680.0	0.400
JP233 HB876			27.6	198.0	7.2	4850.0	0.900
JP233 SG357			28.4	199.0	7.0	2945.0	1.310

Table 7. (cont)

STREBO	MW-1		42.2	209.0	5.0	10000.0	1.750
MATRA			12.8	92.0	7.2	550.0	0.205
BELUGA			14.2	131.0	9.2	671.0	0.250
Runway Denial							
BAP-100	Runway Buster		3.9	71.0	18.0	80.0	0.050
Durandal	Runway Buster		8.8	98.0	11.1	440.0	0.180
Chem/Fuel Bombs							
MK-12	Chemical Bomb		14.0	109.0	7.8	1000.0	0.250
Big Eye	Chemical Bomb		13.3	90.0	6.8	436.0	0.230
Bombs							
Mark-89 PB			4.0	33.0	8.3		0.030
Mark-81	MK-86 PB		9.0	76.5	8.5	270.0	0.080
Mark-81-R	Snake Eye		9.0	76.1	8.5	300.0	0.120
Mark-82	MK-87 PB		10.8	89.6	8.3	505.0	0.130
Mark-82-R	Snake Eye, BSU-49		10.8		0.0	550.0	0.220
Mark-83	Mod 400		14.0	118.4	8.5	985.0	0.190
Mark-83-R	MK-40, MAU-91 A/B			113.5	#####		0.390
Mark-84	MK-88 PB Mod 83		18.0	153.5	8.5	1970.0	0.310
Mark-84-R	GBU		18.0	150.0	8.3	2123.0	0.710
Mark-117			16.0	87.0	5.4	820.0	0.200
Mark-117-R			16.0	82.0	5.1	880.0	0.480
Mark-118			24.1	132.0	5.5	3020.0	0.790
Mark-116 A2			18.5	138.0	7.5		0.330
Mark-30 E2			16.0	90.0	5.6		0.470
Mark-20	Rock Eye Mod 2		13.3	92.0	6.9	486.0	0.270
MLU-32	B-99		8.3	63.0	7.6	154.0	0.160
Gun Pods							
MK-4			22.5	191.0	8.5		1.100
SUU-16/A			22.0	200.0	9.1		0.870
GEPOD 30 mm	488#ammo, 106#Links		24.0	165.0	6.9	2000.0	0.800
Pylons							
Long Heavy Pylon							0.420
F-16A,C LH Pylon	Forward Step						0.540
Short Pylon							0.200
Tangent Tandem	(2) Mk-84						0.330
Racks							
LAU-3C/A -D/A -61/A -A/A -69A -A/A			15.7	77.0	4.9		0.450
LAU-69A -A/A			15.7	85.0	5.4		0.450
LAU-3/A -A/A			15.7	86.0	5.5		0.310
LAU-60/A			15.7	95.0	6.1		0.310
LAU-10/A			13.9	140.0	10.1		0.300
LAU-32/A	59A Rocket Pod		9.8	67.1	6.8		0.180
LAU-34/A	AGM-45						0.170

TABLE 7. (cont)

LAU-68/A, B			9.8	71.0	7.2		0.190
LAU-88/A	Triple Rail, AGM-65						0.990
LAU-106	AIM-7, -120						0.150
LAU-114/A	AIM-9						0.090
LAU-117	Single Rail, AGM-65						0.200
LAU-118/A	AGM-88						0.170
LAU-128/A	AIM-9, -120						0.110
LAU-5003/A			15.7	77.0	4.9		0.450
TER-9	Triple Ejector (3)						0.350
MER-5	Multiple Ejector (5)						0.750
	Multiple Ejector (4)						0.600
MER-10	Multiple Ejector (6)						0.850
BRU-26	? (6)						1.250
BRU-40	Lo-Profile Ejector (4)						1.140
BRU-40M	Lo-Profile Ejector (2)						1.160
Fuel Tanks							
300 Gallon			24.0	160.0	6.7		0.530
370 Gallon			26.0	240.0	9.2		0.550
600 Gallon			34.4	260.0	7.6		0.900
150 Gallon			16.5	165.0	10.0		0.270
275 Gallon			24.0	210.0	8.8		0.480
330 Gallon							0.540
ASAT							
ASAT & Pylon			20.0	215.0	10.8		1.750
Pylon Only							0.750
Electronic War							
ALQ-101, -2			10.0	101.0	10.1		0.180
ALQ-101-3, -4			10.0	157.0	15.7		0.200
ALQ-71, -176	Fins		10.0	115.0	11.5	350.0	0.200
ALQ-72	ECU		10.0	99.0	9.9		0.240
ALQ-87	ECU, Fins		10.5	107.0	10.2		0.210
ALQ-81, -88			10.0	191.0	19.1		0.380
ALQ-31			23.0	184.0	8.0	1000.0	0.860
ALQ-119-12			10.0	154.0	15.4	~600	0.710
ALQ-131			17.5	126.0	7.2	~700-800	0.750
AN/ASQ-T11, -T13	Pod					160.0	
AN/AWG-16			10.0	92.0	9.2	168.0	0.200
Pave Penny	Includes Pylon					83.0	0.060
74x AD204E	Hardback Beacon Pod		11.2	36.0	3.2	78.0	0.210
Lantirn Target Pod	Includes Pylon		16.5	99.0	6.0	~980-105	0.720
Lantirn Navigation Pod	Includes Pylon		19.1	74.0	3.9	430.0	0.940

VII. PROPULSION MODULE

A. OVERVIEW

The Propulsion module will compute the on and off design characteristics of a turbojet or turbofan engine using cycle analysis. There are seven main assumptions used during the calculations [Ref 2:p. 163]

- Bypass ratio is constant at design value
- Compressor operates along compressor backbone only
- The turbine is assumed to be choked
- The combustor pressure drop is constant
- Where the fan and outer compressor have a different number of stages, the fan characteristics are scaled from outer compressor characteristics.
- Thermodynamic properties include the effects of fuel addition but do not include dissociation.
- The compressor reference point equals the compressor design point.

Six engines are available for selection and the one that most closely matches the design should be chosen. Each engine has an associated set of default variables. If the engine desired is not one of the default engines, simply alter the variables to suit the requirements. Table 8 gives the default engines and their default values. It should be noted that not all values are

given for each engine. Acceptable ranges for some of the engine efficiencies may be found in Oates [Ref 6:p. 224].

B. PROPULSION INPUTS

There are seven pages of available variables in CREATE. Default values shown are for the J-85 engine where applicable. The variables are:

- Engine diameter (ft). If engine diameter, length and weight are all 0.0, ACSYNT will attempt to size the engine.
  Default: 1.365, Range: [0.0, 30.0], Type: Real
- Engine length (ft)
  Default: 9.16, Range: [0.0, 60.0], Type: Real
- Engine weight (lbs).
  Default: 608.0, Range: [0.0, 100000.0], Type: Real
- Inner turbine flow area (ft^2) (at the stator position).
  Default: 0.242, Range: (0.0, 10.0], Type: Real
- Bypass ratio.
  Default: 0.0, Range: [0.0, 30.0], Type: Real
- Engine face diameter (ft)
  Default: 1.365, Range: [0.0, 30.0], Type: Real
- Nozzle fineness ratio (nozzle length/nozzle max diameter).
  Default: 0.0, Range: > 0.0, Type: Real
- Cowl fineness ratio (cowl length/cowl max diameter).
  Default: 0.0, Range: > 0.0, Type: Real
- Engine hub/tip ratio.
  Default: 0.6, Range: (0.0, 1.0], Type: Real
- Fuel heating value (BTU/lb_m) (JP-4 = 18600.0)
  Default: 18600.0, Range: [14000.0, 55000.0], Type: Real

- Scaling factor for inlet capture area (1.0 = capture area equals inlet area).
  Default: 1.0, Range: [0.5, 1.5], Type: Real

- Engine percent corrected airflow.
  Default: 100.0, Range: [50.0, 150.0], Type: Real

- Maximum nacelle diameter factor (1.0 = nacelle diameter equals engine diameter).
  Default: 1.15, Range: [1.0, 2.0], Type: Real

- Total nacelle length factor (1.0 = nacelle length equals engine length).
  Default: 2.0, Range: [1.0, 3.0], Type: Real

- Engine face mach number.
  Default: 0.6, Range: (0.0, 2.0], Type: Real

- Distance between the nozzle centerlines divided by the nozzle diameter (this accounts for interference drag due to multiple nozzles). Use 1.0 for one engine.
  Default: 1.0, Range: >= 1.0, Type: Real

- Nozzle velocity coefficient (accounts for incomplete expansion and other losses).
  Default: 0.98, Range: [0.6, 1.0], Type: Real

- Cooling airflow/primary airflow ratio.
  Default: 0.0, Range: [0.0, 0.2], Type: Real

- Year of engine installation. Used when ACSYNT sizes the engine (i.e. length, weight and diameter are all 0.0)
  Default: 63.0, Range: None, Type: Real

- Engine thrust with afterburner at sea-level (the engine sizing flag in the Trajectory Module should be set to -2).
  Default: 4080.0, Range: [0.0, 999999.0], Type: Real

- Engine thrust without afterburner at sea-level (the engine sizing flag in the Trajectory module should be set to -3).
  Default: 2720.0, Range: [0.0, 999999.0], Type: Real

- Thrust/weight ratio at take-off (the engine sizing flag in the Trajectory Module should be set to -1).
  Default: 0.5, Range: (0.0, 10.0], Type: Real
  *** Only one of the above three variables is used, as determined by the engine sizing flag in the Trajectory inputs ***

- Afterburner adiabatic efficiency.
  Default: 0.75, Range: [0.6, 1.0], Type: Real

- Combustor adiabatic efficiency.
  Default: 0.87, Range: [0.6, 1.0], Type: Real

- Ductburner adiabatic efficiency.
  Default: 0.75, Range: [0.6, 1.0], Type: Real

- Compressor adiabatic efficiency.
  Default: 0.80, Range: [0.6, 1.0], Type: Real

- Fan adiabatic efficiency.
  Default: 0.82, Range: [0.6, 1.0], Type: Real

- Turbine adiabatic efficiency.
  Default: 0.90, Range: [0.6, 1.0], Type: Real

- Design fan pressure ratio.
  Default: 1.0, Range: [1.0, 10.0], Type: Real

- Outer compressor pressure ratio.
  Default: 1.0, Range: [1.0, 15.0], Type: Real

- Overall compressor pressure ratio.
  Default: 7.0, Range: [3.0, 50.0], Type: Real

- Combustor pressure ratio.
  Default: 0.95, Range: [0.6, 1.0], Type: Real

- Afterburner pressure ratio with burner lit.
  Default: 0.94, Range: [0.6, 1.0], Type: Real

- Afterburner pressure ratio without burner lit.
  Default: 0.94, Range: [0.6, 1.0], Type: Real

- Ductburner pressure ratio with ductburner lit.
  Default: 0.98, Range: [0.6, 1.0], Type: Real

- Ductburner pressure ratio without ductburner lit.
  Default: 0.82, Range: [0.6, 1.0], Type: Real

- Average compressor stage pressure rise (psi).
  Default: 1.27, Range: [1.0, 3.0], Type: Real

- Turbine inlet temperature (degrees R).
  Default: 2160.0, Range: [1500.0, 4000.0], Type: Real

- Afterburner max temperature (degrees R) (0.0 = no afterburner).
  Default: 0.0, Range: > 0.0, Type: Real

- Ductburner max temperature (degrees R) (0.0 = no ductburner).
  Default: 0.0, Range: > 0.0, Type: Real

- Incremental inlet total pressure recovery reduction, used with inlet pressure recovery code below (input as a positive number)
  Default: 0.0, Range: [0.0, 1.0], Type: Real

- Inlet pressure recovery code
  1 = (AIA ram recovery) - (incremental inlet total pressure recovery reduction)
  2 = (Mil-Spec 5008B) - (incremental inlet total pressure recovery reduction)
  3 = (normal shock) - (incremental inlet total pressure recovery reduction)
  4 = Table look-up
  Default: 3, Range: [1, 4], Type: Integer

- Number of engines (this should equal the number of pods).
  Default: 2, Range: [1, 10], Type: Integer

- Specific fuel multiplying factor for condition 1.
  Default: 1.0, Range: [0.3, 3.0], Type: Real

- Upper limit on Mach number where the specific fuel consumption multiplying factor for condition one is valid.
  Default: 1.0, Range: (0.0, 3.0], Type: Real

The above two variables (and the two below) are typically used after the specific fuel consumption has been determined by a previous convergence run. If the calculated SFC is greater than or less than the expected SFC, it may be altered for a given Mach range by setting the SFC multiplying factor to a value other than one. The Mach numbers specifying the two conditions may not overlap.

- Specific fuel multiplying factor for condition 2.
  Default: 1.0, Range: [0.3, 3.0], Type: Real

- Lower limit on Mach number where the specific fuel consumption multiplying factor for condition two is valid.
  Default: 1.1, Range: (0.0, 3.0], Type: Real

- Specific fuel consumption multiplying factor for burner lit (applied after the two previous factors have been added).
  Default: 1.0, Range: [0.3, 10.0], Type: Real

- Scale factor for nozzle boat-tail drag.
  Default: 0.0, Range: [0.0, 2.0], Type: Real

- Scale factor for total installation drag.
  Default: 0.0, Range: [0.0, 2.0], Type: Real

- Scale factor for nozzle interference drag.
  Default: 0.0, Range: [0.0, 2.0], Type: Real

- Altitudes for detailed output. An array of 6 values. This array will be matched up with the Mach number array below.
  Default: 0.0, Range: [0.0, 99999.0], Type: Real

- Mach numbers for detailed output. An array of 6 values. This array is matched up with the altitude array above.
  Default: 0.0, Range: [0.0, 3.0], Type: Real

- The number of altitude/Mach number combinations above that do not have the afterburner lit.
  Default: 6, Range: [0, 6], Type: Integer

- Engine type indicator.
  0 = Turbojet
  2 = Turbofan
  Default: 0, Range: 0 or 2, Type: Real

- Afterburner indicator.
  0 = No afterburner
  -1 = Afterburner is present but not lit
  2 = Afterburner lit
  Default: -1, Range: 0 or -1 or 2, Type: Real

- Ductburner indicator.
  0 = No afterburner
  -1 = Afterburner is present but not lit
  2 = Afterburner lit
  Default: 0, Range: 0 or -1 or 2, Type: Real

Table 8. [Ref 3]

Default Engine Values						
Variable	**J-85**	**TF-30**	**JT-8D**	**JT-9D**	**CF-6**	**Generic**
Inner Turbine Flow Area	0.242	0.328	0.411	0.385	0.385	0.385
Bypass Ratio	0.0	0.73	1.03	8.2	4.4	6.23
Engine Face Diameter	1.365	3.8	3.655		8.2	8.2
AB Adiabatic Efficiency						0.75
Combustor Adiab Efficiency	0.87	0.94	0.94	0.98	0.94	0.87
Ductburner Adiab Efficiency						0.75
Compressor Adiab Efficiency	0.8	0.8	0.82	0.82	0.82	0.8
Fan Adiabatic Efficieniency						0.9
Turbine Adiabatic Efficiency				0.92	0.92	0.92
Hub/Tip Ratio	0.6	0.6	0.4	0.3	0.3	0.6
Design fan pressure ratio	1.0	2.43	1.91	1.6	1.56	1.51
Outer comp pressure ratio	1.0	7.41	4.2	1.6	1.72	1.396
Overall comp pressure ratio	7.0	21.8	16.9	22.9	30.0	20.1
Combustor presssure ratio	0.95		0.95			0.97
AB pressure ratio, lit		0.92	0.96			0.98
AB pressure ratio, not lit	0.94	0.88	0.98	0.96	0.92	0.98
Ductburner pressure ratio						0.98
DB pressure ratio, not lit						0.98
Avg comp stage rise	1.27	1.21	1.2	1.2	1.21	1.21
Thrust with burner	4080.	25100.	0.0	0.0	0.0	0.0
Thrust, no burner	2720.	14560.	14500.	50000.	50280	9300.
Turbine inlet temp	2160.	2743.	2180.	2835.	2800.	2637.
Cooling/primary air ratio	0.0	0.018	0.0	0.02	0.02	0.0
Year of installation	63.0	71.0	68.0	70.0	70.0	70.0
Length	9.16	15.18	10.31	14.08	14.86	8.67
Weight	608.0	3790.0	3218.0	8874.0	9767.	1421.0

VIII. WEIGHTS MODULE

A. OVERVIEW

Aircraft weights are calculated based on the aircraft type (fighter, transport or bomber), geometric size and gross weight. A "slope factor" is applied to the various aircraft systems and structures to determine an estimate of the weights. A Slope of 1.0 should be used initially for the first convergence run. If the calculated weights are greater or less than the expected weight, then the slope may be altered to suit the requirement. As an example, a slope of 0.7 could be applied to the wing to account for an advanced composites structure. Each of the component weights are computed internally to ACSYNT and are based on historical data for all metal components.

B. WEIGHTS INPUT

CREATE uses four separate pages for input. The variables are:

- Wing slope.
  Default: 1.0, Range: [0.0, 3.0], Type: Real
- Fuselage slope.
  Default: 1.0, Range: [0.0, 3.0], Type: Real
- Horizontal tail and/or canard slope.
  Default: 1.0, Range: [0.0, 3.0], Type: Real

- **Vertical tail slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Nacelles slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Landing gear slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Engines slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Fuel systems slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Hydraulics and pneumatics slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Electrical system slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Avionics slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Instrumentation slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Environmental control slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Passenger accommodations slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Auxiliary power unit (APU) slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Flight controls slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- **Crew accommodations slope.**
  Default: 1.0, **Range:** [0.0, 3.0], **Type:** Real

- Payload weight (lbs) (includes ammunition, cargo, passengers, etc...).
  Default: 0.0, Range: >= 0.0, Type: Real

- Wing pivot factor (for swept wings only). Used in the same fashion as a slope factor.
  Default: 1.0, Range: [0.0, 3.0], Type: Real

- External tank factor. Used like a slope factor.
  Default: 1.0, Range: [0.0, 3.0], Type: Real

- Maximum Mach number (for transports and bombers only).
  Default: 0.85, Range: [0.0, 3.0], Type: Real

- Oblique wing material density (lbs/in^3).
  Default: 0.056, Range: [0.0, 1.0], Type: Real

- Oblique wing allowable stress (psi).
  Default: 30000.0, Range: [5000.0, 100000.0]

- Wing weight equation
  0 = standard wing
  1 = delta wing
  Default: 0, Range: 0 or 1, Type: Integer

- Oblique wing weight equation
  0 = standard wing
  1 = oblique wing
  Default: 0, Range: 0 or 1, Type: Integer

- Tail indicator
  0 = standard tail
  1 = T-tail
  Default: 0, Range: 0 or 1, Type: Integer

- Body equation
  1 = uses Sanders body equation
  2 = Air Force body equation
  Default: 1, Range: 1 or 2, Type: Integer

- Wing weight technique (used only with Transports and Bombers)
  1 = Sanders wing equation
  2 = Air Force wing equation
  3 = Langley wing equation
  Default: 1, Range: [1, 3], Type: Integer

- Estimate of gross weight. This is the starting value for the convergence (lbs).
  Transports = 100000.0
  Fighters = 20000.0
  Bombers = 50000.0

- Weight of Ammunition (lbs).
  Default: 0.0, Range: >= 0.0, Type: Real

- Weight of Bombs (lbs).
  Default: 0.0, Range: >= 0.0, Type: Real

- Weight of Missiles (lbs).
  Default: 0.0, Range: >= 0.0, Type: Real

- Weight of External Tanks (lbs).
  Default: 0.0, Range: >= 0.0, Type: Real

IX. NAVY MODULE

A. OVERVIEW

The Navy module was originally developed at NPS to aid in the study of a carrier based, high-energy laser equipped aircraft for fleet air defense. Its sole purpose is to determine if the design is compatible with the C13-1 catapult and the MK 7 MOD 3 arresting gear as installed on the CVN-68 class carriers.

The catapult is assumed to be operating at maximum capacity for the launch, regardless of the aircraft weight. This will provide the highest catapult endspeed (liftoff speed) possible to minimize the required wind over the deck (A low wind over the deck is desirable to reduce the requirement for a high ship speed). In this case, the catapult system is operating at 520 psig receiver pressure. The gross weight vs end speed curve [Ref 7:p. 4-28] was fitted with a 7th order Lagrange Polynomial [Ref 8] to obtain an equation suitable for use in the program. The final endspeed is that due to the catapult added to the velocity due to the aircraft thrust.

Likewise, the aircraft engaging speed for the arresting gear is the highest possible engaging speed for the current weight of the aircraft. This also provides the minimum wind over the deck requirements.

Aircraft performance is based on tropical day conditions at sea-level, to provide a worse-case scenario. The vertical component of the engine thrust is added to the lift of the aircraft based on the aircraft AOA.

No specific inputs are required for the Navy module. All calculations are internal to the program. When using this module with CREATE, three items must be established. First, the module must be selected. Second, a value for the gear down drag should be entered in the "Total drag due to additional items" variable in the Aerodynamics module. The drag supplied will be used whenever the aircraft is less than 0.3 Mach. Third, the flap/slat settings for takeoff and landing should be set to achieve 90% of C_L max. The last two items are not required but recommended for accurate results. For low thrust aircraft with large flap areas, a very high drag (greater than thrust available) may be encountered with high catapult endspeeds. A reduction of the flap setting may reduce the drag coefficient sufficiently to get airborne.

X. EXAMPLE ONE

A. INTRODUCTION

To serve as a detailed introduction to NPSASP, the A-10 Thunderbolt II (Fig 4) will be re-created. Each step of the design process will be covered from initiating a data file to evaluating the output from ACSYNT, and every module will be utilized. It is assumed that the user has an active account on the Aeronautics Department Vax computer system and has some experience with Vax commands and terminology.

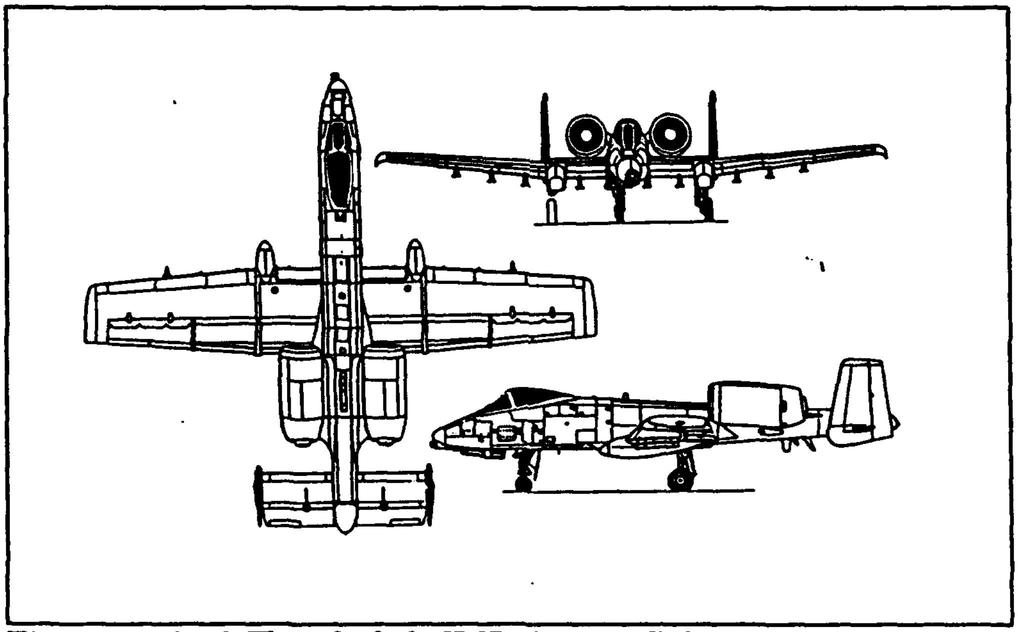


Figure 5. A-10 Thunderbolt II [Ref 10:p. 375]

B. A-10 DESIGN INPUTS

If N/A appears next to a variable, that item is not applicable to this design. It may be ignored.

- Login on the Vax and type "DESIGN" (It may be necessary to create a new subdirectory at this point, if so directed). This command will bring up the opening screen for NPSASP, with several menu options.

- Select item (1) from the opening menu (RUN CREATE). This starts CREATE to begin building the aircraft data file.

- Select item (2) (CREATE A NEW FILE).

- Enter a filename of "A10". CREATE will automatically add a three letter extension to the filename of ".ACS" to distinguish it from other files in the directory. If the filename selected conflicts with an existing file, CREATE will ask for a different name to use.

- Select item (1) (SIMPLE ANALYSIS).

- Enter a project title of "A-10 THUNDERBOLT". This should not be confused with the initial file name.

- Select item (3) (BOMBER). This is used later on by the Weights module to establish the weights.

- This is the Module Selection Menu. The first five modules are required and may not be changed. The Navy module should be selected by just typing a "10" at the prompt. The "NO" will change to a "YES". Enter a "0" to continue.

- Select item (1), Change the weight to 60000.0, then (2) to continue. If for some reason ACSYNT can not converge the design, this is the maximum weight that will be investigated.

- This is the Geometry Selection Menu. Each feature that the design incorporates should be selected here. In this case, items 1, 4, 5, 8, 9, 10 and 11 should be set to "YES"

- Symmetric Wing Geometry:
  - Aspect Ratio: 6.54
  - Surface Area: 506.0 (ft^2)
  - Dihedral: 7.0 deg
  - Fuel Density: 48.62 (lbs/ft^3) (JP-4)
  - Leading Edge Flap Width: 0.12
  - Leading Edge Sweep: 0.0 deg
  - Wetted Area Multiplier: 0.99
  - Taper Ratio: 0.66
  - T/C Ratio, Wing Root: 0.16
  - T/C Ratio, Wing Tip: 0.13
  - Trailing Edge Flap Width (% chord): 0.35
  - Fraction of Wing Volume Filled with Fuel: 0.19
  - Position of Wing Quarter Chord: 0.47
  - Elevation of Wing on Fuselage: -1.0
  - Enter "0" to continue to the next menu.

- Horizontal Tail Geometry:
  - Aspect Ratio: 2.99
  - Surface Area: 110.0
  - Tail Volume Coefficient: 1.0
  - LE Sweep: 0.0
  - Wetted Area Multiplier: 1.1 (this a little higher than normal to try and account for the extra drag produced by the tail design)
  - Taper Ratio: 0.99
  - T/C Ratio, Root: 0.13
  - T/C Ratio, Tip: 0.13
  - Position of TE of the Root Chord: 0.97
  - Elevation of Tail on Fuselage: 0.0
  - Sizing Logic: T
  - Horizontal Tail Sizing Fraction: 0.234 (The horizontal tail will be sized using the wing area * sizing fraction)
  - Enter "0" to continue

- Vertical Tail Geometry :
  - Aspect Ratio: 1.74
  - Surface Area: 50.0 (the area of 1 tail)
  - Tail Volume Coefficient: 0.1 (not required since the sizing fraction is non-zero).
  - LE Sweep: 0.0
  - Wetted Area Multiplier: 1.1
  - Taper Ratio: 0.61
  - T/C Ratio, Root: 0.13

- T/C Ratio, Tip: 0.12
- Number of Vertical Tails: 2.0
- X Location of TE of the Root Chord: 0.97
- Elevation of the Root Chord of the Tail on Fuselage: -.9
- Sizing Logic: T
- Vertical Tail Sizing Fraction: 0.107
- Enter "0" to continue

- Enter "1" for the number of fuselage pods. (There are 2 pods symmetrically located).

- Fuselage Pod Geometry:
  - Engine Pod Diameter: 4.88
  - Engine Pod Length: 10.89
  - Stand-Off Distance: 0.2
  - Angular Orientation: 0.0
  - X Location of Pod Leading Edge: 0.6
  - Wing Pod Symmetry: 0
  - Enter "0" to Continue

- Fuselage Geometry:
  - Maximum Fuselage Diameter: 5.26
  - Fuselage Length: 53.33
  - Diameter of Nose Radar Dish: 0.0
  - Afterbody Fineness Ratio: 5.5
  - Fuselage Fineness Ratio: 0.0
  - Nose Fineness Ratio: 1.94
  - Length of Radar Equipment Behind Radar: 0.0
  - Surface Area Complexity Factor: 1.0
  - Fuselage Wall Thickness: N/A
  - Mission Fuel Weight Estimate: 12000.0
  - Tail Type: 1
  - Enter "0" to Continue

- Crew Cockpit Geometry :
  - Length of Crew Station: 0.0 (let ACSYNT size it)
  - Width of Crew Station: 0.0
  - Number of Crew Members: 1
  - Seating Arrangement: T
  - Enter "0" to Continue

- 1 Fuselage Fuel Bay
  - Fuel Density: 48.62 (JP-4)

- Trajectory Page 1:
  - Cruise Mach Number: 0.45
  - Mach Number for Max Endurance: 0.27
  - Design Load Factor: 7.0
  - Ultimate Load Factor: 11.25
  - Aircraft Range: 1000.0
  - Maximum Dynamic Pressure: 700.0
  - Take-Off Obstacle Requirement: 0
  - Enter "0" to Continue

- Trajectory Page 2:
  - Time for Warm-up and Taxi: 5.0
  - Power Setting During Warm-up and Taxi: 5
  - Time for Take-off: 2.0
  - Power Setting for Take-off: 2
  - Breguet Altitude Search Flag: 0
  - Loiter Altitude Search Flag: 0
  - Enter "0" to Continue

- Trajectory Page 3:
  - Fuel Reserve: 0.05
  - Total Internal Fuel: 11130.0
  - External Fuel: 0.0
  - Weight of Trapped Fuel: 111.0
  - Engine Sizing Flag: -3
  - Number of Cruise Phases (see below): 4
  - Total number of Trajectory Phases (see below): 8
  - Debug Option: 0
  - Enter "0" to Continue

- Trajectory Phases. Eight phases will be used to simulate a combat mission. The values are given below. Note that each phase is presented on a different page. For the combat phase, input 5.0 g's for item (8). Drop bombs and ammunition during the combat phase using items (11) and (12) on the menu.

TABLE 9. A-10 Mission

Phase	Mach Start	Mach End	Alt Start	Alt End	Horiz Dist	Horiz Time	Power Setting
Climb	0.00	0.00	100	5000	0.0	0.0	2
Cruise	0.5	0.5	5000	5000	230	44.0	4
Cruise	0.5	0.5	100	100	40	8.0	4
Combat	0.6	0.6	100	100	0	30.0	3
Cruise	0.5	0.5	100	100	40	8.0	4
Climb	0.00	0.00	100	5000	0.0	0.0	2
Cruise	0.5	0.5	5000	5000	230.0	44.0	4
Loiter	0.27	0.27	500	500	10.0	20.0	4

- Aerodynamics Page 1:
  - Ratio of Body Base Area to Max Body Area: 0.08
  - Angle of Attack for C_L max: 11.0
  - Maximum Angle of Attack: 19.0
  - Width of the Fuselage at the Nose: 5.26
  - Boat Tail Exposure Factor: 1.0
  - C_L max Scaling Factor for clean aircraft: 1.0
  - Laminar-Turbulent Weighting Factor: 1.0
  - Enter "0" to Continue

- Aerodynamics Page 2:
  - Ref Mach Number Array: 0.15, 0.20, 0.30, 0.40, 0.45, 0.49, 0.53, 0.57, 0.60, 0.70
  - C_L at Zero AOA for Body: 0.005, 0.005, 0.005, 0.005, 0.005, 0.005, 0.005, 0.005, 0.005, 0.005
  - Canard C_L at Zero AOA: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Wing C_L at Zero AOA: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Zero Lift Pitching Moment: 0.048, 0.048, 0.047, 0.047, 0.047, 0.047, 0.047, 0.047, 0.047, 0.047
  - Wing Sweep Angles: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Enter "0" to Continue

- Aerodynamics Page 3:
  - No Entries for Page 3
  - Enter "0" to Continue

- Aerodynamics page 4:
  - Wing Airfoil Section Code: 2
  - Wing LE Radius/Chord Ratio: N/A
  - Canard Airfoil Section Code: N/A
  - Canard LE Radius/Chord Ratio: N/A
  - Distance Between the Twin Nacelles: N/A
  - Supercritical Wing Flag: 0
  - Body Cross-section Code: 1
  - Enter "0" to Continue

- Aerodynamics Page 5:
  - Pod Cowl Exposure Factor: 1.0
  - Friction Drag Multiplying Factor: 0.95
  - Canard Incidence: N/A
  - Average Flap Chord: 3.485
  - Total Area of Both Wing Flaps: 81.3
  - Total Span of Both Flaps: 0.0 (Not used for trim)
  - Desired Location of CG: 0.26
  - Static Margin for CG: 0.13
  - Height of CG Above Fuselage Centerline: 0.0
  - Horizontal Tail Incidence: 0.0
  - Enter "0" to Continue

- Aerodynamics Page 6:
  - Mach Numbers for Detailed Aero Output: 0.2, 0.3, 0.6, 0.7
  - Total Number of Requested Mach Numbers: 4
  - Altitudes for Detailed Aero Output: 0.0, 0.0, 5000.0, 5000.0
  - Lift Coefficients for Detailed Output: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Enter "0" to Continue

- Aerodynamics Page 7:
  - Drag due to External Bombs: 2.12 (4 AGM-65's, 4 LAU-117's)
  - Drag due to External Stores: 0.0
  - Drag due to Drop Tanks: 0.0
  - Drag due to Additional Items: 2.2 (for gear down drag, Navy module)
  - Enter "0" to Continue

- Aerodynamics Page 8:
  - C_l max for Landing: -1.0
  - C_L max for Take-off: -1.0
  - TE Flap Angle for Landing: 30.0
  - TE Flap Angle for Take-off: 20.0
  - LE Slat Angle for Landing: 15.0
  - LE Slat Angle for Take-off: 15.0
  - L/D Ratio for Landing: -1.0
  - L/D Ratio for Take-off: -1.0
  - Enter "0" to Continue

- Engine Type: Change to Type 2 (TF-30)

- Propulsion Page 1:
  - Engine Diameter: 4.35
  - Engine Length: 8.33
  - Engine Weight: 1478.0
  - Inner Turbine Flow Area: 0.385
  - Bypass Ratio: 6.23
  - Engine Face Diameter: 3.86
  - Nozzle Fineness Ratio: 0.0
  - Cowl Fineness Ratio: 0.0
  - Enter "0" to Continue

- Propulsion Page 2:
  - Engine Hub/Tip Ratio: 0.55
  - Fuel Heat Value: 18600.0
  - Scaling Factor for Inlet Capture Area: 1.0
  - Engine Percent Corrected Airflow: 100.0
  - Maximum Nacelle Diameter Factor: 1.15
  - Total Nacelle Length Factor: 1.307
  - Engine Face Mach Number: 0.5
  - Distance Between Nozzles/Nozzle Diameter: 2.0
  - Nozzle Velocity Coefficient: 0.98
  - Enter "0" to Continue

- Propulsion Page 3:
  - Cooling/Primary Airflow Ratio: 0.0
  - Year of Installation: 75.0
  - Thrust w/Afterburner: N/A
  - Thrust w/o Afterburner: 9065.0
  - Thrust/Weight Ratio at Take-off: N/A
  - Afterburner Adiabatic Efficiency: N/A

- Combustor Adiabatic Efficiency: 0.87
- Ductburner Adiabatic Efficiency: N/A
- Compressor Adiabatic Efficiency: 0.8
- Enter "0" to Continue

- Propulsion Page 4:
  - Fan Adiabatic Efficiency: 0.9
  - Turbine Adiabatic Efficiency: 0.92
  - Design Fan Pressure Ratio: 1.51
  - Outer Compressor Pressure Ratio: 1.396
  - Overall Compressor Pressure Ratio: 21.0
  - Combustor Pressure Ratio: 0.97
  - Afterburner Pressure Ratio: N/A
  - Afterburner Pressure Ratio, Not Lit: N/A
  - Ductburner Pressure Ratio: N/A
  - Ductburner Pressure Ratio, Not Lit: N/A
  - Enter "0" to Continue

- Propulsion Page 5:
  - Average Compressor Stage Rise: 1.24
  - Turbine Inlet Temp: 2697.0
  - Afterburner Max Temp: 0.0
  - Ductburner Max Temp: 0.0
  - Incremental Inlet Total Press Recovery Reduction: 0.0
  - Number of Engines: 2
  - Inlet Pressure Recovery Code: 3
  - Enter "0" to Continue

- Propulsion Page 6:
  - SFC Multiplying Factor for Condition One: 1.0
  - Upper Limit on Mach Number for Condition One: 1.0
  - SFC Multiplying Factor for Condition Two: 1.0
  - Lower Limit on Mach Number for Condition Two: 1.1
  - SFC Multiplying Factor for Burner Lit: N/A
  - Scale Factor for Nozzle Boat-Tail drag: 1.0
  - Scale Factor for Total Installation Drag: 1.0
  - Scale Factor for Nozzle Interference Drag: 1.0
  - Enter "0" to Continue

- Propulsion Page 7:
  - Altitudes for Detailed Output: 0.0, 0.0, 5000.0, 5000.0, 5000.0, 10000.0
  - Mach Numbers for Detailed Output: 0.0, 0.5, 0.5, 0.57, 0.7, 0.7
  - Number of Altitude/Mach Number Combinations without the Afterburner lit: 6
  - Engine Type Indicator: 2
  - Afterburner Indicator: 0
  - Ductburner Indicator: 0
  - Nozzle Type Indicator: 0
  - Enter "0" to Continue

- Weights Page 1:
  - Wing Slope: 1.1
  - Fuselage Slope: 1.2
  - Horizontal Tail: 1.2
  - Vertical Tail: 1.0
  - Nacelles: 2.018
  - Landing Gear: 0.9
  - Engines: 0.897
  - Fuel System: 1.0
  - Hydraulics: 1.3
  - Enter "0" to Continue

- Weights Page 2:
  - Electrical System: 1.0
  - Avionics: 1.0
  - Instrumentation: 1.0
  - Environmental System: 1.0
  - Passenger Accommodations: 1.0
  - APU: 1.0
  - Flight Controls: 1.37
  - Crew Accommodations: 1.0
  - Payload: 14000.0
  - Enter "0" to Continue

- Weights Page 3:
  - Wing Pivot Factor: 0.0
  - External Tank Factor: 0.0
  - Maximum Mach Number: 0.7
  - Oblique Wing Material Density: N/A
  - Oblique Wing Allowable Stress: N/A
  - Wing Weight Equation: 0
  - Oblique Wing Weight Equation: 0

- Tail Indicator: 0
- Body Equation: 1
- Wing Weight Technique: 3
- Estimate of Take-off Gross Weight: 60000.0
- Enter "0" to continue

- Weights Page 4:
  - Weight of Ammunition: 1000.0
  - Weight of Bombs: 1848.0
  - Weight of Missiles: 0.0
  - Weight of External Tanks: 0.0
  - Enter "0" to continue

The ACSYNT data file is complete. The main NPSASP menu is now presented. Option (2), run ACSYNT, should now be selected. Input the name of the data file (A10) when requested. This simple analysis problem will take about 4 minutes to complete.

If everything was entered correctly the output file should appear like the one on pages 81-109. If a value was entered incorrectly and ACSYNT crashes, ensure that the four commands given on page 6 are executed prior to running CREATE again.

C. OUTPUT EVALUATION

The output file from ACSYNT has the same name as the input file (A10), but the extension is ".OUT" instead of ".ACS", and it will appear with some other files in the root directory. The output file may be viewed on the terminal screen or printed out. If it is printed out, the wide tractor printer should be used as the printout is 130 columns wide in places.

The important variables are defined within the following sections. Definitions of other variables can be found in Reference 4.

The first 4 pages of the output deal with the control structure that ACSYNT will use for this analysis. This structure is established within CREATE and will change depending on the analysis method selected. The final page is a summary of the more valuable results.

1. Geometry Output

Page 85 is a print out of the variables input to the Geometry module. Some of these values are those input to CREATE and others are set internally. Page 86 defines the initial fuselage using the input values. The pods are not shown on the initial output. "X" represents the fuselage length (measured from the nose), "R" is the radius, and "AREA" is the area of the cross-section at location "X". Additional information is at the bottom of page 86 concerning fuselage volume and surface area. Page 87 shows the initial dimensions of the aircraft surfaces. This is a valuable means for ensuring that the design geometry is correct.

The final output from the Geometry section begins on page 92. The pod (nacelle) information now appears. The final dimensions of the planar surfaces on page 93 shows the calculated values for the horizontal and vertical tail areas, re-sized based on the sizing fraction as requested.

2. Trajectory Output

The initial Trajectory data appears on page 88 with the output beginning on page 94. Notice that the ending altitudes (given by "H") are higher than requested due to the aircraft climbing slightly as fuel is burned off. This can be prevented by using a "-1" for the ending altitude. Following the mission output is a printout of the combat parameters for 1 g flight, sustained flight and instantaneous. The ouput variables are:

- M: Mach Number
  SFC(I): Installed Specific Fuel Consumption
  SFC(U): Uninstalled SFC
  H: Altitude (ft)
  THRUST(I): Installed Thrust
  THRUST(U): Uninstalled Thrust
  CL: Lift Coefficient
  CD: Drag Coefficient
  CDINST: Engine Installation Drag Coefficient
  ALPHA: Angle of Attack
  GAMMA: Climb Angle (deg)
  WFUEL: Fuel burned for that Phase
  W: Aircraft Weight at end of Phase
  TIME: Phase Flight Time (sec)
  WA: Engine Airflow (lb/sec) per engine
  PR: Pressure Recovery
  VEL: Velocity in ft/sec
  Q: Dynamic Pressure
  X: Phase Distance (nm)
  WFTO1: Warm-up and Taxi Fuel
  WFTO2: Take-off Fuel
  PS: Specific Excess Power
  NZ: Normal Load Factor
  TDOT: Turning Rate (deg/sec)
  RADIUS: Radius of Turn

3. Aerodynamics Output

The Aerodynamics output begins on page 95. There are four separate sections that match to the four altitude/Mach number combinations that were requested for the detailed aerodynamics output. Under EXTERNAL, only the EXTRA (drag due to additional items) is output. The drag due to bombs, stores and tanks are computed but not shown. Most of the terms are self explanatory. The "Zone" refers to the internal calculation method used.

4. Propulsion Output

The Propulsion output on page 98 is quite detailed. All of the variables are defined at the beginning of the section. The six sections correlate with the six altitude/Mach number combinations requested.

5. Weights Output

The calculated values shown on page 107 include the slope factors that were selected. If the weight shown is too high or low, adjust the slope to bring the value into range. The calculated weight was the weight computed for the most recent pass through the mission and the estimated weight is the next estimate. Since the two values agree within .0001 (.01%) ACSYNT terminated the run.

6. Navy Output

The output from the Navy module (page 108) is clear cut. The minimum wind over the deck requirements for launch is based on 1.1 times the stall speed minus the liftoff speed. The landing requirements are similarly based. Notice the high C_d during landing do to the larger flap setting.

7. Convergence Information

The aircraft convergence information begins on the bottom of page 90. Error messages from each module can normally be found in this section. In this case, two different warnings are present. The first indicates that the combat load factor that was input during the combat phase (5 g's) is too much for the design to handle for a sustained period. ACSYNT automatically decreased it to a sustainable level of 4.0 g's (page 95). The second error, near the bottom of page 91, indicates that there is insufficient thrust if an engine is lost off the catapult. This is verified in the Navy output.

D. EXAMPLE ONE COMPLETION

After ACSYNT completes its run, it does not update the aircraft data file with the final numbers. This means that the design must be re-converged if the same file is run again. To establish the data file as converged, it must be updated. In particular, the final value for the gross weight must be input (47121 lbs. Weights section), the mission fuel required should be updated (11443 lbs, Fuselage section), the combat g loading should be reduced from 5.0

to 4.0 (Trajectory combat phase), the areas for the horizontal and vertical tails should be updated (118.4 and 54.1, respectively) and the sizing flag should be changed to "F". To accomplish this, run CREATE again and perform the following steps:

- Select item (1) (Open a Previously Created File)
- No change to Analysis Method.
- Select (3) Bomber
- No change to Module Select Menu
- No change to the maximum weight
- Select (1), change Geometry module
- No change to Geometry Selection Menu
- Skip past the Wing.
- Update the horizontal tail and vertical tail (areas and sizing flag)
- Skip by the fuselage pods
- Change the mission fuel weight estimate on the Fuselage Geometry Menu to the new value
- Skip past the Crew Cockpit and Fuselage Fuel Bays.
- Select (1), change Trajectory module
- Skip the first 3 pages of the Trajectory data.
- Select (1), change Trajectory phases.
- Change the ending altitudes to -1 to prevent the slow climb. Change the g loading during combat to 4.0

- No changes to the Aerodynamics or Propulsion modules.
- Select (1), Change Weights module
- Skip to page 3 of the Weights data and input the new Take-off gross weight estimate (47121.0)
- Skip the last Weights page and exit.

The Simple Analysis Method of the A-10 is now complete. Sensitivity and Optimization studies may now be performed. If the data file is run through ACSYNT again, a slightly different answer may be output for the final gross weight due to the different starting value. This new value is typically within a few pounds of the first value and is not significant.

```
CCCCCCC    OOOOOOO    PPPPPPP    EEEEEEE    SSSSSSS
C          O     O    P     P    E          S
C          O     O    P     P    E          S
C          O     O    PPPPPPP    EEEE       SSSSSSS
C          O     O    P          E                S
C          O     O    P          E                S
CCCCCCC    OOOOOOO    P          EEEEEEE    SSSSSSS
```

C O N T R O L   P R O G R A M

F O R

E N G I N E E R I N G   S Y N T H E S I S

T I T L E

A-10 THUNDERBOLT

```
TITLE:
A-10 THUNDERBOLT


CONTROL PARAMETERS;
CALCULATION CONTROL,                     NCALC =    1
NUMBER OF GLOBAL DESIGN VARIABLES,         NDV =    0
NUMBER OF SENSITIVITY VARIABLES,           NSV =    0
NUMBER OF FUNCTIONS IN TWO-SPACE,        N2VAR =    0
NUMBER OF APPROXIMATING VAR.            NXAPRX =    0
INPUT INFORMATION PRINT CODE,           IPNPUT =    1
DEBUG PRINT CODE,                        IPDBG =    0

CALCULATION CONTROL, NCALC
VALUE   MEANING
  1     SINGLE ANALYSIS
  2     OPTIMIZATION
  3     SENSITIVITY
  4     TWO-VARIABLE FUNCTION SPACE
  5     OPTIMUM SENSITIVITY
  6     APPROXIMATE OPTIMIZATION


* * ESTIMATED DATA STORAGE REQUIREMENTS

            REAL                                  INTEGER
INPUT  EXECUTION  AVAILABLE         INPUT  EXECUTION  AVAILABLE
   9          9       5000             1          1       1000
```

```
AAAAAAA   CCCCCCC   SSSSSSS   Y     Y   N     N   TTTTTTT
A     A   C         S          Y   Y    NN    N      T
A     A   C         S           Y Y     N N   N      T
AAAAAAA   C         SSSSSSS      Y      N  N  N      T
A     A   C               S      Y      N   N N      T
A     A   C               S      Y      N    NN      T
A     A   CCCCCCC   SSSSSSS      Y      N     N      T
```

N A S A - A M E S   P R O G R A M

F O R

A I R C R A F T   S Y N T H E S I S

NAVAL POSTGRADUATE SCHOOL VERSION

T I T L E

A-10 THUNDERBOLT

AIRCRAFT TYPE - BOMBER

```
TITLE:
A-10 THUNDERBOLT


AIRCRAFT TYPE - BOMBER


CONTROL PARAMETERS:
READ CONTROL,                              MREAD =    6
EXECUTION CONTROL,                         MEXEC =    4
WRITE CONTROL,                            MWRITE =    6
NUMBER IDENTIFYING CONVERGENCE
  VARIABLE FOR CONVERGED VEHICLE,          IOBJ =  570
NUMBER IDENTIFYING COMPARISON
  VARIABLE FOR CONVERGED VEHICLE,          JOBJ =  585
SUMMARY OUTPUT PRINT CODE,                 IPSUM =    1
GLOBAL ERROR PRINT CODE,                  KGLOBP =    0
GLOBAL COMMON INITIALIZATION CODE,         INIT =    0
DEBUG PRINT CODE,                          IPDBG =    2
GLOBAL PLOT CONTROL,                       IGPLT =    1
DATA TRANSFER INFORMATION FILE, IRDDTR       =    7
DATA TRANSFER INFORMATION PRINT, IPDTR       =    0


VEHICLE CONVERGENCE INFORMATION:
CONVERGENCE TOLERANCE, TOL = 0.10000E-03
ESTIM WCALC VS WEXT SLOPE  = 0.75000E+00
BOUNDING WEIGHT, WGMAX     = 0.60000E+05


MODULE IDENTIFICATION NUMBERS:

 NUMBER        MODULE
    1         GEOMETRY
    2         TRAJECTORY
    3         AERODYNAMICS
    4         PROPULSION
    5         STABILITY AND CONTROL
    6         WEIGHTS
    8         GLOBAL I/O
   10         NAVY
   11         SUMMARY OUTPUT
   14         TAKEOFF AND LANDING

MODULES ARE CALLED FOR INPUT IN THE FOLLOWING ORDER:
    1    2    3    4    6   10

MODULES ARE CALLED FOR EXECUTION IN THE FOLLOWING ORDER:
    1    2    6  -10

MODULES ARE CALLED FOR OUTPUT IN THE FOLLOWING ORDER:
    1    2    3    4    6   10
CALLING MODULE NUMBER  1
```

```
GEOMETRY DATA CARDS
 1*** GEOMETRY DATA ***
 2 $WING
 3      AR= 6.54,          AREA= 506.00,  DIHED= 7.00,
 4      FDENWG= 48.62,  LFLAPC=0.12,     SWEEP=  0.00,
 5      SWFACT=0.99,     TAPER=0.66,      TCROOT=0.16,
 6      TCTIP=0.13,      TFLAPC=0.35,     WFFRAC=0.19,
 7      XWING=0.47,      ZROOT=-1.00,     KSWEEP=0,
 8      OUTCOD=2,
 9      $END
10 $HTAIL
11      AR= 2.99,          AREA= 110.00,  CVHT=1.00,
12      HTFRAC=0.234,    SWEEP= 0.00,     SWFACT=1.10,
13      TAPER=0.99,      TCROOT=0.13,     TCTIP=0.13,
14      XHTAIL=0.97,     ZROOT=0.00,      KSWEEP=0,
15      OUTCOD=2,        SIZIT=T,
16      $END
17 $VTAIL
18      AR= 1.74,          AREA=  50.00,  CVVT=0.10,
19      SWEEP= 0.00,     SWFACT=1.10,     TAPER=0.61,
20      TCROOT=0.13,     TCTIP=0.12,      VTFRAC=0.107,
21      VTNO=2.0,        XVTAIL=0.97,     YROOT=0.00,
22      ZROOT=-.90,      KSWEEP=0,        OUTCOD=2,
23      SIZIT=T,
24      $END
25 $FPOD
26      DIAM=  4.88,     LENGTH= 10.89, SOD= 0.20,
27      THETA= 0.00,     X=0.6,           OUTCOD=2,
28      SYMCOD=0,
29      $END
30 $FUS
31      BDMAX= 5.26,     BODL= 53.33,     DRADAR= 0.00,
32      FRAB= 5.50,      FRATIO= 0.00,    FRN= 1.94,
33      LRADAR= 0.00,    SFFACT= 1.00,    WALL= 0.00,
34      WFUEL= 12000.0,OUTCOD=2,          ITAIL=1,
35      $END
36 $CREW
37      LENGTH=  0.00, WIDTH=  0.00,    NCREW= 1,
38      OUTCOD=2,        TAND=T,
39      $END
40 $FUEL
41      DEN=48.62,       FRAC=1.00,       WFUEL=      0.0,
42      OUTCOD=2,
43      $END

END OF GEOMETRY DATA CARDS
  43 CARDS READ


REW SEATING REQUIREMENTS
NUMBER OF CREW..............    1.0
TANDEM SEATING..............      T
CREW LENGTH REQUIRED........    0.0
CREW WIDTH  REQUIRED........    3.5
```

NASA/AMES A C S Y N T **INITIAL OUTPUT**

FUSELAGE DEFINITION

X	R	AREA
0.00	0.00	0.00
1.07	0.78	1.92
2.13	1.26	4.98
3.20	1.63	8.36
4.27	1.93	11.69
5.33	2.17	14.74
6.40	2.35	17.36
7.47	2.49	19.43
8.53	2.58	20.86
9.60	2.62	21.62
10.67	2.63	21.73
11.73	2.63	21.73
12.80	2.63	21.73
13.87	2.63	21.73
14.93	2.63	21.73
16.00	2.63	21.73
17.07	2.63	21.73
18.13	2.63	21.73
19.20	2.63	21.73
20.27	2.63	21.73
21.33	2.63	21.73
22.40	2.63	21.73
23.47	2.63	21.73
24.53	2.63	21.73
25.60	2.63	21.67
26.67	2.62	21.53
27.73	2.60	21.30
28.80	2.58	20.98
29.86	2.56	20.58
30.93	2.53	20.09
32.00	2.49	19.52
33.06	2.45	18.87
34.13	2.40	18.15
35.20	2.35	17.35
36.26	2.29	16.49
37.33	2.23	15.55
38.40	2.15	14.57
39.46	2.07	13.52
40.53	1.99	12.43
41.60	1.90	11.30
42.66	1.80	10.14
43.73	1.69	8.95
44.80	1.57	7.75
45.86	1.44	6.55
46.93	1.31	5.36
48.00	1.16	4.21
49.06	0.99	3.10
50.13	0.81	2.08
51.20	0.61	1.16
52.26	0.37	0.42
53.33	0.00	0.00

FUSELAGE

MAX. DIAMETER......	5.260
FINENESS RATIO.....	10.139
SURFACE AREA.......	702.864
VOLUME.............	809.360

NASA/AMES   A C S Y N T   **INITIAL OUTPUT**
DIMENSIONS OF PLANAR SURFACES

	WING	H.TAIL	V.TAIL	CANARD	UNITS
PLAN AREA..........	506.0	110.0	50.0	0.0	(SQ.FT.)
SURFACE AREA.......	1012.4	173.0	94.3	0.0	(SQ.FT.)
VOLUME.............	464.5	60.7	24.1	0.0	(CU.FT.)
SPAN...............	57.526	18.136	9.327	0.000	(FT.)
L.E. SWEEP.........	0.000	0.000	0.000	0.000	(DEG.)
C/4 SWEEP..........	-1.794	-0.096	-3.982	0.000	(DEG.)
T.E. SWEEP.........	-7.140	-0.385	-15.559	0.000	(DEG.)
ASPECT RATIO	6.540	2.990	1.740	0.000	
ROOT CHORD.........	10.598	6.096	6.659	0.000	(FT.)
ROOT THICKNESS.....	20.347	9.510	10.388	0.000	(IN.)
ROOT T/C	0.160	0.130	0.130	0.000	
TIP CHORD..........	6.994	6.035	4.062	0.000	(FT.)
TIP THICKNESS......	10.911	9.415	5.849	0.000	(IN.)
TIP T/C	0.130	0.130	0.120	0.000	
TAPER RATIO	0.660	0.990	0.610	0.000	
MEAN AERO CHORD....	8.919	6.065	5.465	0.000	(FT.)
LE ROOT AT.........	22.416	45.634	45.071	0.000	(FT.)
C/4 ROOT AT........	25.065	47.158	46.736	0.000	(FT.)
TE ROOT AT.........	33.013	51.730	51.730	0.000	(FT.)
LE M.A.C. AT.......	22.416	45.634	45.071	0.000	(FT.)
C/4 M.A.C. AT......	24.645	47.151	46.437	0.000	(FT.)
TE M.A.C. AT.......	31.335	51.700	50.536	0.000	(FT.)
Y M.A.C. AT........	13.400	4.526	4.287	0.000	
LE TIP AT..........	22.416	45.634	45.071	0.000	(FT.)
C/4 TIP AT.........	24.164	47.143	46.087	0.000	(FT.)
TE TIP AT..........	29.410	51.669	49.133	0.000	(FT.)
ELEVATION..........	-2.630	0.000	-2.367	0.000	(FT.)
VOLUME COEFF.		0.549	0.037	0.000	

E X T E N S I O N S

	Strake	Rear Extension
Centroid location at.......	0.000	0.000
Area.......................	0.000	0.000
Wetted Area................	0.000	0.000
Volume.....................	0.000	0.000
Sweep Angle................	0.000	

F U E L   T A N K S

TANK	VOLUME	WEIGHT	DENSITY
WING	84.	4103.	48.62
FUS#1	0.	0.	48.62
FUS#2	0.	0.	50.00
TOTAL		4103.	

MISSION FUEL REQUIRED=   0.

AVAILABLE FUEL VOLUME IN WING=   444.

AIRCRAFT WEIGHT =   0.000 Lbs.
AIRCRAFT VOLUME =   1358.592 Cu.Ft.
AIRCRAFT DENSITY =   0.000 Lbs./Cu.Ft.
CASE= 4
CALLING MODULE NUMBER 2

TRAJECTORY INPUT

```
TIMTO1 = 5.0         MENDUR =     0.     NCRUSE = 4     IPLOT = 0
TIMTO2 = 2.0           QMAX =   700.     IPSIZE =-3     HMINP =      0.
FRFURE = 0.05         XDESC =   80.0     IPSTO1 = 5     HMAXP = 40000.
DESLF =, 7.00        WKFUEL = 1.000      IPSTO2 = 2     DELHP =   4000.
 ULTLF =11.25        CRMACH = 0.450       IBREG = 0    SMMINP = 0.300
 RANGE =  1000.      WKLAND = 0.570      IENDUR = 0    SMMAXP = 0.900
 WFUEL =  11130.      FLFAC = 0.600      IPRINT = 0     DELMP = 0.100
 WFEXT =      0.      DECEL = 0.250      KERROR = 2    WCOMBP =       0.50
WFTRAP =    100.     NLEGCL = 0          NLEGCR = 0    NLEGLO = 0
FWGMAX = 1.200          TOL = 0.001      MILCOM = 0     NMISS = 1
                                                        NCODE = 0
 MMPROP = 1
```

MISSION 1

PHASE	MACH NO. START	MACH NO. END	ALTITUDE START	ALTITUDE END	HORIZONTAL DIST	HORIZONTAL TIME	NO. TURN	VIND "G"S	WKFUEL	M	IP	IX	W	B	A	P
CLIMB	0.00	0.00	100	5000	0.0	0.0	0.0	0.0	1.0000	1	2	0	0	0	0	0
CRUISE	0.50	0.50	5000	5000	230.0	44.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
CRUISE	0.50	0.50	100	100	40.0	8.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
COMBAT	0.60	0.60	100	100	0.0	30.0	0.0	5.0	1.0000	1	3	0	0	1	1	0
CRUISE	0.50	0.50	100	100	40.0	8.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
CLIMB	0.00	0.00	100	5000	0.0	0.0	0.0	0.0	1.0000	1	2	0	0	0	0	0
CRUISE	0.50	0.50	5000	5000	230.0	44.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
LOITER	0.27	0.27	500	500	10.0	20.0	0.0	0.0	1.0000	1	4	0	0	0	0	0

CALLING MODULE NUMBER 3
CALLING MODULE NUMBER 4

```
                    PROPULSION INPUT
                     VERSION 04-76

*** PROPULSION DATA ***


 AENDIA =      4.350  AENLE   =      8.330  AENWT   =   1478.000
 ALTI   =      0.000  AM      =      0.000  ATURB   =      0.385
 AENTW  =      0.000
 AUAENG =      0.000  AWAENG  =      0.157  BA      =      6.230
 DELPR  =      0.000  DELT57  =    100.000  DEPWCC  =      2.000
 DIA1   =      3.860  EAB1    =      0.750  EB1     =      0.870
 ED1    =      0.750  ETAC1   =      0.800  ETAF1   =      0.900
 ETAT1  =      0.920  HTR     =      0.550  HVF     =  18600.000
 MACH1  =      1.000  MACH2   =      1.100  PCDFAC  =      1.000
 POSA   =     29.920  PRFD    =      1.510  PWCC    =    100.000
 P11P1  =      1.396  P2P1    =     21.000  R10A    =     -1.000
 R32    =      0.970  R54     =      0.920  R54N    =      0.880
 R711   =      0.980  R711N   =      0.820  SCPR    =      1.240
 SFADP  =      1.000  SFADSP  =      1.000  SFAUXP  =      1.000
 SFBEP  =      1.000  SFBPP   =      1.000  SFBTP   =      1.000
 SFDIVP =      1.000  SFINSP  =      1.000  SFIP    =      1.000
 SFSFC1 =      1.000  SFSFC2  =      1.000  SFSFC3  =      1.000
 SM1    =      0.500  SODG    =      2.000  TOSA    =    518.000
 TR     =    520.000  TWAB    =     25100.   TWOAB   =      9065.
 TWTO   =      0.500  T3      =      2697.   T5M     =      3400.
 T51    =         0.  T7M     =      3400.   T71     =         0.
 VC1    =      0.980  WCWA1   =      0.000  XMDES   =      0.850
 XMT    =      0.850  YREN    =        75.  FRBT    =      0.000
 FRPN   =      0.000  RDIAM   =      1.150  RLENG   =      1.307


 IPR    =          3  IPRINT  =          0  IPLOT   =          0
 KERROR =          0  KODE    =          2  KT5     =          0
 KT7    =          0  MINPR   =          1  NAB     =          6
 NOZZ   =          0  NPROP   =          6  NSUMM   =         15
                                            IENG    =          2 (TF30)


 THESE VARIABLES ARE USED BY TABLE LOOK UP
 ESF    =     1.000  NDTAIL    = 0  IPDBUG  = 0  IIPRINT = 0


 ALTD   =        0.          0.      5000.      5000.      5000.     10000.
 XMACH  =     0.000      0.500      0.500      0.570      0.700      0.700
 XMPRI  =     0.000      0.300      0.600      0.900      1.200      4.000
 XPRI   =     1.000      1.000      1.000      1.000      1.000      1.000
 XMPRI1 =      0.000      0.000      0.000      0.000      0.000      0.000      0.000
               0.000      0.000      0.000
 XPRI1  =     0.000      0.000      0.000      0.000      0.000      0.000      0.000
              0.000      0.000      0.000
 XMPRI2 =      0.000      0.000      0.000      0.000      0.000      0.000      0.000
               0.000      0.000      0.000
 XPRI2  =     0.000      0.000      0.000      0.000      0.000      0.000      0.000
              0.000      0.000      0.000
    CALLING MODULE NUMBER  6
```

```
                         INITIAL WEIGHTS INPUT DATA
                         ACSYNT MODULE NUMBER 6
AIRCRAFT TYPE:  BOMBER
TITLE:  *** WEIGHTS DATA ***

CONTROL OPTIONS

    IPRINT =  1    IGRAPH =  1    ITAIL  =  0    KERROR =  0
    IDELT  =  0    IOBLIQ =  0    KWING  =  3    KBODY  =  1
    K1     = 1.00 K2     = 1.00 K3     =  1.0 K4     =  1.0
    K5     = 1.00 K6     = 1.00 AFMACH = 0.70 MAXIT  =  1
    KB     = 0.00 KP1    = 0.00 KP2    = 0.00
    FR     = 1.00 TECHG  = 1.00 WGTO   =    60000.
    STRESS =    30000.          DENS   =  0.056      FLIFTF =0.000
    TECHI  =  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
  SLOPE(1) =  1.10  1.20  1.20  1.00  2.02  0.90  0.90  1.00
  SLOPE(9) =  1.30  1.00  1.00  1.00  1.00  1.00  1.00  1.37  1.00

INITIAL ESTIMATES
 IF CODE = 1, WEIGHT IS FIXED

 QUANTITY      VALUE   CODE           QUANTITY      VALUE   CODE

  WAF    =     15600.   0              WAIRC  =      360.   0
  WAPU   =         0.   0              WAMMUN =     1000.   1
  WARM   =         0.   0              WBAG   =        0.   0
  WBB1   =         0.   0              WBODY  =     6600.   0
  WCAND  =         0.   0              WCARGO =        0.   0
  WCREW  =       360.   0              WE     =     7800.   0
  WELT   =      2520.   0              WEP    =      840.   0
  WETANK =         0.   0              WFEQ   =     7200.   0
  WFS    =       780.   0              WCA    =      840.   0
  WGEAR  =       360.   0              WHDP   =       30.   0
  WHT    =      1200.   0              WINST  =      180.   0
  WLG    =      1800.   0              WMISS  =        0.   0
  WNA    =      1440.   0              WPA    =        0.   0
  WPASS  =         0.   0              WPL    =    14000.   1
  WPS    =      8400.   0              WSC    =     1800.   0
  WTSUM  =     60000.   0              WVT    =      540.   0
  WWING  =      4800.   0              WBOMB  =     1848.   1
  WENVP  =         0.   0              WPIV   =        0.   0
  WLIFTF =         0.   0              WBB2   =        0.   0
    CALLING MODULE NUMBER 10


                  INPUT VALUES TO NAVY MODULE

             CLMAX = 1.80
             SIGMA = 0.94449
            VSOUND =  679.6
               ALT =      0.


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.54000E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
```

```
WARNING : Combat load factor reduced from input value of     5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48771E+05

    SLOPE OF WCALC VS WEST LINE = 0.75000E+00

    ESTIMATED GROSS WEIGHT  = 0.37800E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.44878E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.47117E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of     5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47118E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of     5.000000
    CALLING MODULE NUMBER  6
    CALLING MODULE NUMBER  1
```

NASA/AMES A C S Y N T **FINAL OUTPUT**

FUSELAGE DEFINITION

X	R	AREA
0.00	0.00	0.00
1.07	0.78	1.92
2.13	1.26	4.98
3.20	1.63	8.36
4.27	1.93	11.69
5.33	2.17	14.74
6.40	2.35	17.36
7.47	2.49	19.43
8.53	2.58	20.86
9.60	2.62	21.62
10.67	2.63	21.73
11.73	2.63	21.73
12.80	2.63	21.73
13.87	2.63	21.73
14.93	2.63	21.73
16.00	2.63	21.73
17.07	2.63	21.73
18.13	2.63	21.73
19.20	2.63	21.73
20.27	2.63	21.73
21.33	2.63	21.73
22.40	2.63	21.73
23.47	2.63	21.73
24.53	2.63	21.73
25.60	2.63	21.67
26.67	2.62	21.53
27.73	2.60	21.30
28.80	2.58	20.98
29.86	2.56	20.58
30.93	2.53	20.09
32.00	2.49	19.52
33.06	2.45	18.87
34.13	2.40	18.15
35.20	2.35	17.35
36.26	2.29	16.49
37.33	2.23	15.55
38.40	2.15	14.57
39.46	2.07	13.52
40.53	1.99	12.43
41.60	1.90	11.30
42.66	1.80	10.14
43.73	1.69	8.95
44.80	1.57	7.75
45.86	1.44	6.55
46.93	1.31	5.36
48.00	1.16	4.21
49.06	0.99	3.10
50.13	0.81	2.08
51.20	0.61	1.16
52.26	0.37	0.42
53.33	0.00	0.00

NACELLE DEFINITION

X-XNOSE	R	AREA
0.00	2.18	14.92
2.72	2.18	14.92
8.17	2.18	14.92
10.89	2.18	14.92

NACELLE LOCATION

X	Y	Z
32.00	5.25	0.00
32.00	-5.25	0.00

	FUSELAGE		**PODS**
MAX. DIAMETER......	5.260	.....	4.359
FINENESS RATIO.....	10.139		
SURFACE AREA.......	702.864	.....	149.095 (EACH)
VOLUME.............	809.360		

NASA/AMES A C S Y N T **FINAL OUTPUT**

DIMENSIONS OF PLANAR SURFACES

	WING	H.TAIL	V.TAIL	CANARD	UNITS
PLAN AREA..........	506.0	118.4	54.1	0.0	(SQ.FT.)
SURFACE AREA.......	1012.4	189.0	102.8	0.0	(SQ.FT.)
VOLUME.............	464.5	67.8	27.1	0.0	(CU.FT.)
SPAN...............	57.526	18.816	9.706	0.000	(FT.)
L.E. SWEEP.........	0.000	0.000	0.000	0.000	(DEG.)
C/4 SWEEP..........	-1.794	-0.096	-3.982	0.000	(DEG.)
T.E. SWEEP.........	-7.140	-0.385	-15.559	0.000	(DEG.)
ASPECT RATIO	6.540	2.990	1.740	0.000	
ROOT CHORD.........	10.598	6.324	6.929	0.000	(FT.)
ROOT THICKNESS.....	20.347	9.866	10.810	0.000	(IN.)
ROOT T/C	0.160	0.130	0.130	0.000	
TIP CHORD..........	6.994	6.261	4.227	0.000	(FT.)
TIP THICKNESS......	10.911	9.768	6.087	0.000	(IN.)
TIP T/C	0.130	0.130	0.120	0.000	
TAPER RATIO	0.660	0.990	0.610	0.000	
MEAN AERO CHORD....	8.919	6.293	5.687	0.000	(FT.)
LE ROOT AT.........	22.416	45.406	44.801	0.000	(FT.)
C/4 ROOT AT........	25.065	46.987	46.533	0.000	(FT.)
TE ROOT AT.........	33.013	51.730	51.730	0.000	(FT.)
LE M.A.C. AT.......	22.416	45.406	44.801	0.000	(FT.)
C/4 M.A.C. AT......	24.645	46.979	46.223	0.000	(FT.)
TE M.A.C. AT.......	31.335	51.699	50.488	0.000	(FT.)
Y M.A.C. AT........	13.400	4.696	4.461	0.000	
LE TIP AT..........	22.416	45.406	44.801	0.000	(FT.)
C/4 TIP AT.........	24.164	46.971	45.857	0.000	(FT.)
TE TIP AT..........	29.410	51.667	49.028	0.000	(FT.)
ELEVATION..........	-2.630	0.000	-2.367	0.000	(FT.)
VOLUME COEFF.		0.586	0.040	0.000	

E X T E N S I O N S

	Strake	Rear Extension
Centroid location at.......	0.000	0.000
Area.......................	0.000	0.000
Wetted Area................	0.000	0.000
Volume.....................	0.000	0.000
Sweep Angle................	0.000	

F U E L T A N K S

TANK	VOLUME	WEIGHT	DENSITY
WING	84.	4103.	48.62
FUS#1	151.	7341.	48.62
FUS#2	0.	0.	50.00
TOTAL		11443.	

MISSION FUEL REQUIRED= 11443.

AVAILABLE FUEL VOLUME IN WING= 444.

AIRCRAFT WEIGHT = 47116.801 Lbs.
AIRCRAFT VOLUME = 1368.732 Cu.Ft.
AIRCRAFT DENSITY = 34.424 Lbs./Cu.Ft.
CASE= 4
CALLING MODULE NUMBER 2

TRAJECTORY OUTPUT

MISSION 1 (PAYLOAD = 14000. LB)

PHASE	M SFC(I) SFC(U)	H THRUST(I) THRUST(U)	CL CD CDINST	ALPHA GAMMA L/D	WFUEL W THR/THA	TIME WA PR	VEL Q X
CLIMB	0.50	5000.	0.2887	2.43	103.8	0.92	551.
	0.58	11233.	0.0259	8.82	46668.0	307.73	311.
CYCLE	0.57	0.	0.0009	11.15	2.00	1.00	5.
CRUISE	0.50	6164.	0.2993	2.53	2413.8	42.55	546.
	0.84	3942.	0.0262	0.00	44254.2	245.97	297.
CYCLE	0.81	4086.	0.0010	11.41	0.72	1.00	230.
CRUISE	0.50	298.	0.2370	1.98	505.6	7.26	558.
	0.92	4541.	0.0245	0.00	43748.7	297.98	367.
CYCLE	0.88	4715.	0.0009	9.68	0.72	1.00	40.
COMBAT	0.60	100.	0.6475	5.49	3793.9	30.00	670.
	0.65	11737.	0.0435	0.00	37106.7	356.36	531.
CYCLE	0.63	12018.	0.0010	14.90	1.94	1.00	198.
CRUISE	0.50	334.	0.1987	1.64	500.4	7.26	558.
	0.94	4368.	0.0236	0.00	36606.3	297.13	367.
CYCLE	0.90	4540.	0.0009	8.42	0.69	1.00	40.
CLIMB	0.48	5000.	0.2466	2.08	77.8	0.70	525.
	0.57	11354.	0.0248	12.35	36528.5	303.76	282.
CYCLE	0.56	0.	0.0009	9.96	2.00	1.00	3.
CRUISE	0.50	6454.	0.2343	1.95	2345.1	42.57	546.
	0.88	3636.	0.0244	0.00	34183.4	242.72	295.
CYCLE	0.85	3776.	0.0009	9.60	0.67	1.00	230.
LOITER	0.27	500.	0.6370	6.13	717.6	20.00	301.
	0.83	2608.	0.0486	0.00	33465.8	248.41	106.
CYCLE	0.81	2652.	0.0008	13.12	0.36	1.00	59.

FUEL SUMMARIES

```
MISSION FUEL =  10803.
RESERVE FUEL =    540.
TRAPPED FUEL =    100.
-------------------------
TOTAL FUEL   =  11443.

TAKEOFF FUEL
WFTO1 =    120.
WFTO2 =    225.

FUEL CARRIED :
EXTERNALLY =      0.
INTERNALLY =  11443.
```

ADDITIONAL COMBAT PARAMETERS

	CONDITIONS	PS	NZ	TDOT	RADIUS	ALPHA	CL	CD
M= 0.60	1 G FLIGHT	86.2	1.00	0.00	0.	1.26	0.163	0.0227
H= 100.	SUSTAINED	0.0	4.00	10.68	3594.	5.49	0.647	0.0435
	MAX. INST.	-199.0	7.00	19.07	2012.	10.34	1.131	0.0913

COMBAT ENERGY = 0.155192E+06

```
                      BLOCK TIME  =  2.521  HOURS
                      BLOCK RANGE =  806.2  N. M.
TAKEOFF FIELD LENGTH(TOTAL RUN)   =  2769.  FEET
LANDING FIELD LENGTH(TOTAL RUN)   =  5266.  FEET
LANDING FIELD LENGTH(GROUND RUN)  =  1740.  FEET
  WEIGHT FOR LANDING CALCULATION  =  40651. POUNDS
LANDING THRUST TO WEIGHT RATIO    =  0.472
                  TAKEOFF WEIGHT  =  47117. POUNDS
                  LANDING WEIGHT  =  33466. POUNDS
    CALLING MODULE NUMBER  3
Detailed Aerodynamics Output

Mach     =   0.20
Altitude =     0.
```

Parasite Drag		Induced Drag								
Friction	.0162	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0032	0.0	0.005	0.0263	0.2	0.048	0.00	0.0000	0.0	2
Wing	.0077	3.0	0.323	0.0319	10.1	-.007	0.91	0.0000	0.0	2
Strakes	.0000	6.0	0.617	0.0474	13.0	-.062	0.88	0.0000	0.0	2
H. Tail	.0015	0.0	0.005	0.0263	0.2	0.048	0.00	0.0000	0.0	2
V. Tail	.0016	9.0	0.894	0.0715	12.5	-.119	0.86	0.0000	0.0	2
Canard	.0000	12.0	1.160	0.1039	11.2	-.177	0.84	0.0000	0.0	2
Pods	.0022	15.0	1.422	0.1449	9.8	-.238	0.83	0.0000	0.0	2
Engine	.0000	18.0	1.685	0.1950	8.6	-.302	0.82	0.0000	0.0	2
Cowl	.0000	21.0	1.953	0.2555	7.6	-.367	0.81	0.0000	0.0	2
Boattail	.0000	24.0	2.218	0.3246	6.8	-.431	0.80	0.0000	0.0	2

```
Interference  .0058
Wave          .0000
External      .0043
 Tanks        .0000
 Bombs        .0000
```

```
Slope Factors
  ClAlpha       0.0922
  Cdl^.5Alpha   0.0228
```

Stores	.0000
Extra	.0043
Camber	.0000
Cdmin	.0263

Mach = 0.30
Altitude = 0.

Parasite Drag	
Friction	.0161
Body	.0032
Wing	.0076
Strakes	.0000
H. Tail	.0015
V. Tail	.0016
Canard	.0000
Pods	.0022
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0058
Wave	.0000
External	.0043
Tanks	.0000
Bombs	.0000
Stores	.0000
Extra	.0043
Camber	.0000
Cdmin	.0262

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.005	0.0262	0.2	0.047	0.00	0.0000	0.0	2
3.0	0.329	0.0320	10.3	-.012	0.92	0.0000	0.0	2
6.0	0.628	0.0479	13.1	-.070	0.89	0.0000	0.0	2
0.0	0.005	0.0262	0.2	0.047	0.00	0.0000	0.0	2
9.0	0.909	0.0726	12.5	-.129	0.87	0.0000	0.0	2
12.0	1.177	0.1056	11.1	-.190	0.85	0.0000	0.0	2
15.0	1.438	0.1470	9.8	-.253	0.83	0.0000	0.0	2
18.0	1.698	0.1973	8.6	-.318	0.82	0.0000	0.0	2
21.0	1.967	0.2583	7.6	-.385	0.81	0.0000	0.0	2
24.0	2.155	0.9130	2.4	-.517	0.25	0.0000	0.0	3

Slope Factors	
ClAlpha	0.0896
Cdl^.5Alpha	0.0392

Detailed Aerodynamics Output

Mach = 0.60
Altitude = 5000.

Parasite Drag	
Friction	.0156
Body	.0031
Wing	.0074
Strakes	.0000
H. Tail	.0014
V. Tail	.0016
Canard	.0000
Pods	.0021
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0058
Wave	.0000
External	.0000
Tanks	.0000
Bombs	.0000
Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0214

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.005	0.0214	0.2	0.047	0.00	0.0000	0.0	2
3.0	0.370	0.0284	13.0	-.025	0.95	0.0000	0.0	2
6.0	0.701	0.0474	14.8	-.095	0.92	0.0000	0.0	2
0.0	0.005	0.0214	0.2	0.047	0.00	0.0000	0.0	2
9.0	1.003	0.0759	13.2	-.164	0.90	0.0000	0.0	2
12.0	1.236	0.2444	5.1	-.247	0.33	0.0000	0.0	3
15.0	1.447	0.3612	4.0	-.326	0.30	0.0000	0.0	3
18.0	1.639	0.5010	3.3	-.411	0.27	0.0000	0.0	3
21.0	1.805	0.6610	2.7	-.499	0.25	0.0000	0.0	3
24.0	1.936	0.8336	2.3	-.588	0.22	0.0000	0.0	3

Slope Factors	
ClAlpha	0.0804
Cdl^.5Alpha	0.0375

```
Mach      =    0.70
Altitude =   5000.
```

Parasite Drag		Induced Drag								
Friction	.0154	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0031	0.0	0.005	0.0212	0.2	0.047	0.00	0.0000	0.0	2
Wing	.0073	3.0	0.397	0.0291	13.6	-.031	0.96	0.0000	0.0	2
Strakes	.0000	6.0	0.749	0.0503	14.9	-.106	0.94	0.0000	0.0	2
H. Tail	.0014	0.0	0.005	0.0212	0.2	0.047	0.00	0.0000	0.0	2
V. Tail	.0015	9.0	1.060	0.1647	6.4	-.189	0.38	0.0000	0.0	3
Canard	.0000	12.0	1.284	0.2608	4.9	-.267	0.33	0.0000	0.0	3
Pods	.0021	15.0	1.500	0.3840	3.9	-.350	0.30	0.0000	0.0	3
Engine	.0000	18.0	1.608	0.5556	2.9	-.402	0.24	0.0000	0.0	4
Cowl	.0000	21.0	1.701	0.6924	2.5	-.486	0.21	0.0000	0.0	4
Boattail	.0000	24.0	1.771	0.8377	2.1	-.572	0.19	0.0000	0.0	4
Interference	.0058									
Wave	.0000									
External	.0000									
Tanks	.0000									
Bombs	.0000									
Stores	.0000									
Extra	.0000									
Camber	.0000									
Cdmin	.0212									

Slope Factors	
ClAlpha	0.0736
Cdl^.5Alpha	0.0376

CALLING MODULE NUMBER 4

ENGINE SUMMARY

```
ENGINE DIAMETER =   4.35 FEET
ENGINE LENGTH=  8.33 FEET
ENGINE WEIGHT=  1478.00 POUNDS
BYPASS RATIO =  6.23
NO OF ENGINES PER AC =   2.
A/C DRAG REF AREA =   506.00 SQ FEET
INLET CAPTURE AREA PER ENG =   6.190 SQ FEET
PWCC    = PERCENT OF ENGINE CORRECTED AIRFLOW
THRUST  = ENGINE THRUST (POUNDS PER ENGINE)
SFC     = ENGINE SPECIFIC FUEL CONSUMPTION
WTOT    = ENGINE TOTAL AIRFLOW (LBS/SEC PER ENGINE)
OV EF   = ENGINE OVERALL EFFICIENCY
PR EF   = ENGINE PROPULSIVE EFFICIENCY
TPR     = INLET TOTAL PRESSURE RECOVERY (TO EN FACE)
NPR     = NOZZLE PRESSURE RATIO
TIT     = TURBINE INLET TEMPERATURE (DEG R)
EGT     = ENGINE EXHAUST GAS TEMPERATURE
CPR     = OVERALL COMPRESSOR PRESSURE RATIO
THRUSTU= THRUST PER ENGINE IN LBS, W/O INSTAL DRAG CORR
SFCU    = SFC,1/HR, W/O INSTALLATION DRAG CORR
ABYAC   = FREESTREAM BYPASS FLOW AREA/AC
ABLAC   = FREESTREAM INLET BLEED FLOW AREA/AC
ANOZ    = AREA OF NOZZLE EXIT, FT**2
BETA    = NOZZLE BOATTAIL ANGLE IN DEGREES
AO/AC   = FREE STREAM TO CAPTURE AREA RATIO
CDINS   = TOT INSTALLATION DRAG COEF PER A/C (SWING REF)
CDADD   = ADDITIVE DRAG COEF PER A/C (SWING REF)
CDSP    = SUBSONIC SPILL DRAG COEFF PER A/C (SWING REF)
CDBL    = INLET BLEED DRAG COEF PER A/C (SWING REF)
CDBP    = INLET BYPASS DRAG PER A/C (SWING REF)
CDAUX   = AUX AIR SYSTEM DRAG COEF PER A/C (SWING REF)
CDDIV   = INLET BO. LAYER DIVERT DRAG PER A/C (SWING REF)
CDBT    = NOZZLE BOATTAIL DRAG COEF PER A/C (SWING REF)
CDINF   = DRAG COEF OF BASE AREA BETWEEN NOZZLES (PER A/C)

 INSTALL DRAG COEF SCALE FACTORS
SFINSP =      1.0000
SFADP  =      1.0000
SFADSP =      1.0000
SFBEP  =      1.0000
SFBPP  =      1.0000
SFAUXP =      1.0000
SFDIVP =      1.0000
SFIP   =      1.0000
SFBTP  =      1.0000
```

MACH = 0.000 ALTITUDE = 0.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	9065.	0.364	290.	0.000	0.000	1.000	1.79	2697.	1540.	22.49
	9065.	0.364	0.000	0.000	13.65	11.17				
	1000.000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
98.0	8298.	0.355	285.	0.000	0.000	1.000	1.84	2570.	1486.	21.51
	8298.	0.355	0.000	0.000	13.65	11.84				
	1000.000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
96.0	7495.	0.348	279.	0.000	0.000	1.000	1.92	2447.	1441.	20.56
	7495.	0.348	0.000	0.000	13.65	12.66				
	1000.000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
94.0	6619.	0.348	273.	0.000	0.000	1.000	2.05	2329.	1405.	19.64
	6619.	0.348	0.000	0.000	13.65	13.59				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
92.0	5582.	0.362	267.	0.000	0.000	1.000	2.25	2214.	1380.	18.75
	5582.	0.362	0.000	0.000	13.65	14.62				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
90.0	4076.	0.431	261.	0.000	0.000	1.000	2.54	2105.	1367.	17.88
	4076.	0.431	0.000	0.000	13.65	15.69				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
88.0	2118.	0.717	256.	0.000	0.000	1.000	2.52	1999.	1310.	17.04
	2118.	0.717	0.000	0.000	13.65	16.01				
	1000.000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000
86.0	1872.	0.694	250.	0.000	0.000	1.000	2.22	1898.	1218.	16.23
	1872.	0.694	0.000	0.000	13.65	15.68				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
84.0	1624.	0.677	244.	0.000	0.000	1.000	1.95	1802.	1131.	15.44
	1624.	0.677	0.000	0.000	13.65	15.20				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000

82.0	1375.	0.668	238.	0.000	0.000	1.000	1.70	1709.	1049.	14.68
	1375.	0.668	0.000	0.000	13.65	14.49				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
80.0	1114.	0.678	232.	0.000	0.000	1.000	1.48	1621.	971.	13.95
	1114.	0.678	0.000	0.000	13.65	13.36				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
78.0	827.	0.735	226.	0.000	0.000	1.000	1.27	1536.	897.	13.24
	827.	0.735	0.000	0.000	13.65	11.28				
	1000.000	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0000
76.0	458.	1.039	221.	0.000	0.000	1.000	1.09	1456.	828.	12.56
	458.	1.039	0.000	0.000	13.65	5.40				
	1000.000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000

MACH = 0.500 ALTITUDE = 0.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	6143.	0.594	336.	0.237	0.622	1.000	1.79	2697.	1479.	22.49
	6231.	0.586	0.000	0.000	13.65	9.83				
	1.270	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0004
98.0	5867.	0.619	329.	0.228	0.588	1.000	2.20	2697.	1572.	21.51
	5956.	0.610	0.000	0.000	13.65	11.79				
	1.244	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0003
96.0	5127.	0.630	323.	0.224	0.586	1.000	2.30	2570.	1526.	20.56
	5216.	0.619	0.000	0.000	13.65	12.55				
	1.219	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0003
94.0	4349.	0.655	316.	0.216	0.571	1.000	2.46	2446.	1488.	19.64
	4439.	0.642	0.000	0.000	13.65	13.39				
	1.194	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002
92.0	3509.	0.712	309.	0.200	0.533	1.000	2.70	2326.	1460.	18.75
	3599.	0.694	0.000	0.000	13.65	14.32				
	1.168	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
90.0	2546.	0.854	302.	0.168	0.451	1.000	3.04	2211.	1445.	17.88
	2637.	0.825	0.000	0.000	13.65	15.30				
	1.143	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
88.0	1917.	0.981	296.	0.148	0.406	1.000	3.01	2100.	1384.	17.04
	2008.	0.936	0.000	0.000	13.65	15.63				
	1.117	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0001

86.0	1648.	0.977	289.	0.150	0.430	1.000	2.66	1994.	1288.	16.23
	1739.	0.925	0.000	0.000	13.65	15.40				
	1.092	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
84.0	1383.	0.986	282.	0.150	0.459	1.000	2.34	1892.	1196.	15.44
	1474.	0.925	0.000	0.000	13.65	15.08				
	1.067	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
82.0	1118.	1.020	276.	0.147	0.493	1.000	2.04	1795.	1109.	14.68
	1207.	0.944	0.000	0.000	13.65	14.59				
	1.041	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
80.0	852.	1.101	269.	0.139	0.533	1.000	1.77	1702.	1026.	13.95
	939.	0.999	0.000	0.000	13.65	13.88				
	1.016	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002
78.0	577.	1.311	262.	0.121	0.581	1.000	1.52	1614.	949.	13.24
	660.	1.145	0.000	0.000	13.65	12.76				
	0.990	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002
76.0	280.	2.122	255.	0.083	0.621	1.000	1.30	1530.	876.	12.56
	354.	1.675	0.000	0.000	13.65	10.73				
	0.965	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0002

MACH = 0.500 ALTITUDE = 5000.00 FEET

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	5370.	0.595	285.	0.232	0.596	1.000	2.03	2697.	1523.	22.49
	5443.	0.587	0.000	0.000	13.65	10.80				
	1.270	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0004
98.0	4865.	0.604	279.	0.229	0.590	1.000	2.18	2606.	1510.	21.51
	4939.	0.595	0.000	0.000	13.65	11.76				
	1.245	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0003
96.0	4246.	0.614	273.	0.226	0.588	1.000	2.28	2481.	1464.	20.56
	4320.	0.604	0.000	0.000	13.65	12.50				
	1.219	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0003
94.0	3601.	0.639	268.	0.218	0.574	1.000	2.44	2361.	1428.	19.64
	3675.	0.626	0.000	0.000	13.65	13.35				
	1.194	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002

92.0	2904.	0.694	262.	0.202	0.535	1.000	2.68	2245.	1403.	18.75
	2979.	0.677	0.000	0.000	13.65	14.29				
	1.168	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
90.0	2104.	0.834	256.	0.169	0.453	1.000	3.02	2134.	1389.	17.88
	2180.	0.805	0.000	0.000	13.65	15.28				
	1.143	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
88.0	1582.	0.959	250.	0.149	0.407	1.000	2.99	2027.	1331.	17.04
	1658.	0.915	0.000	0.000	13.65	15.61				
	1.118	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0001
86.0	1359.	0.955	245.	0.151	0.432	1.000	2.65	1925.	1238.	16.23
	1435.	0.905	0.000	0.000	13.65	15.38				
	1.092	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
84.0	1137.	0.966	239.	0.151	0.461	1.000	2.32	1827.	1149.	15.44
	1213.	0.906	0.000	0.000	13.65	15.04				
	1.067	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
82.0	918.	1.000	233.	0.147	0.495	1.000	2.03	1733.	1065.	14.68
	992.	0.925	0.000	0.000	13.65	14.55				
	1.041	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
80.0	697.	1.084	228.	0.139	0.536	1.000	1.76	1643.	986.	13.95
	769.	0.982	0.000	0.000	13.65	13.83				
	1.016	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002
78.0	467.	1.302	222.	0.120	0.584	1.000	1.51	1558.	911.	13.24
	536.	1.134	0.000	0.000	13.65	12.67				
	0.991	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002
76.0	218.	2.186	216.	0.080	0.621	1.000	1.29	1477.	841.	12.56
	279.	1.705	0.000	0.000	13.65	10.56				
	0.965	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0002

MACH = 0.570 ALTITUDE = 5000.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	5230.	0.629	297.	0.252	0.638	1.000	2.03	2697.	1506.	22.49
	5332.	0.617	0.000	0.000	13.65	10.42				
	1.162	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0004

98.0	4833.	0.647	291.	0.246	0.620	1.000	2.30	2643.	1536.	21.51
	4937.	0.633	0.000	0.000	13.65	11.70				
	1.139	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0003
96.0	4207.	0.659	285.	0.242	0.616	1.000	2.41	2517.	1489.	20.56
	4311.	0.643	0.000	0.000	13.65	12.43				
	1.116	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0003
94.0	3561.	0.687	279.	0.233	0.599	1.000	2.57	2395.	1452.	19.64
	3666.	0.667	0.000	0.000	13.65	13.26				
	1.093	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
92.0	2872.	0.747	273.	0.216	0.559	1.000	2.82	2278.	1426.	18.75
	2979.	0.720	0.000	0.000	13.65	14.17				
	1.069	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0002
90.0	2105.	0.887	267.	0.184	0.478	1.000	3.18	2165.	1411.	17.88
	2209.	0.845	0.000	0.000	13.65	15.15				
	1.046	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0002
88.0	1601.	1.008	261.	0.165	0.434	1.000	3.15	2057.	1352.	17.04
	1707.	0.945	0.000	0.000	13.65	15.48				
	1.023	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0001
86.0	1366.	1.011	255.	0.166	0.456	1.000	2.79	1953.	1258.	16.23
	1476.	0.936	0.000	0.000	13.65	15.27				
	1.000	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0002
84.0	1137.	1.029	249.	0.166	0.482	1.000	2.45	1853.	1168.	15.44
	1246.	0.939	0.000	0.000	13.65	14.96				
	0.976	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0002
82.0	912.	1.072	244.	0.162	0.511	1.000	2.14	1758.	1083.	14.68
	1019.	0.959	0.000	0.000	13.65	14.52				
	0.953	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0002
80.0	686.	1.173	238.	0.153	0.543	1.000	1.85	1667.	1002.	13.95
	791.	1.017	0.000	0.000	13.65	13.88				
	0.930	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
78.0	454.	1.427	232.	0.133	0.573	1.000	1.59	1580.	926.	13.24
	555.	1.167	0.000	0.000	13.65	12.87				
	0.907	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0002
76.0	209.	2.435	226.	0.092	0.563	1.000	1.36	1498.	855.	12.56
	301.	1.689	0.000	0.000	13.65	11.14				
	0.883	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0002

MACH = 0.700 ALTITUDE = 5000.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	5013.	0.698	325.	0.284	0.699	1.000	2.03	2697.	1467.	22.49
	5204.	0.673	0.000	0.000	13.65	9.53				
	1.037	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0005
98.0	4790.	0.727	319.	0.274	0.662	1.000	2.49	2697.	1560.	21.51
	4989.	0.698	0.000	0.000	13.65	11.31				
	1.016	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0004
96.0	4219.	0.750	312.	0.267	0.646	1.000	2.70	2595.	1543.	20.56
	4422.	0.716	0.000	0.000	13.65	12.20				
	0.996	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
94.0	3555.	0.786	306.	0.257	0.624	1.000	2.88	2470.	1505.	19.64
	3763.	0.743	0.000	0.000	13.65	13.00				
	0.975	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0003
92.0	2869.	0.854	299.	0.240	0.582	1.000	3.16	2349.	1477.	18.75
	3074.	0.797	0.000	0.000	13.65	13.88				
	0.954	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
90.0	2136.	0.999	293.	0.208	0.505	1.000	3.56	2233.	1461.	17.88
	2329.	0.916	0.000	0.000	13.65	14.82				
	0.933	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
88.0	1643.	1.123	286.	0.191	0.463	1.000	3.53	2121.	1400.	17.04
	1840.	1.002	0.000	0.000	13.65	15.16				
	0.913	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
86.0	1375.	1.149	280.	0.192	0.475	1.000	3.12	2014.	1302.	16.23
	1589.	0.994	0.000	0.000	13.65	15.00				
	0.892	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
84.0	1124.	1.190	273.	0.192	0.488	1.000	2.74	1911.	1209.	15.44
	1343.	0.996	0.000	0.000	13.65	14.75				
	0.871	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
82.0	881.	1.270	267.	0.187	0.502	1.000	2.39	1813.	1121.	14.68
	1098.	1.019	0.000	0.000	13.65	14.39				
	0.850	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002

80.0	642.	1.434	260.	0.178	0.507	1.000	2.07	1719.	1038.	13.95
	856.	1.076	0.000	0.000	13.65	13.88				
	0.830	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
78.0	402.	1.846	254.	0.157	0.489	1.000	1.79	1630.	959.	13.24
	610.	1.218	0.000	0.000	13.65	13.11				
	0.809	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0003
76.0	157.	3.705	247.	0.116	0.370	1.000	1.53	1545.	886.	12.56
	353.	1.650	0.000	0.000	13.65	11.89				
	0.788	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
74.0	-102.	-4.310	241.	0.030	-1.471	1.000	1.30	1464.	817.	11.90
	69.	6.361	0.000	0.000	13.65	9.63				
	0.767	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0003

MACH = 0.700 ALTITUDE = 10000.00 FEET

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	4386.	0.696	274.	0.279	0.673	1.000	2.30	2697.	1513.	22.49
	4547.	0.671	0.000	0.000	13.65	10.39				
	1.037	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0004
98.0	4005.	0.715	268.	0.273	0.656	1.000	2.56	2628.	1526.	21.51
	4170.	0.686	0.000	0.000	13.65	11.45				
	1.017	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0004
96.0	3468.	0.732	263.	0.269	0.648	1.000	2.68	2503.	1479.	20.56
	3636.	0.698	0.000	0.000	13.65	12.16				
	0.996	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
94.0	2921.	0.767	258.	0.259	0.627	1.000	2.86	2381.	1442.	19.64
	3092.	0.724	0.000	0.000	13.65	12.97				
	0.975	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0003
92.0	2355.	0.834	252.	0.241	0.584	1.000	3.14	2265.	1416.	18.75
	2525.	0.778	0.000	0.000	13.65	13.85				
	0.954	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
90.0	1751.	0.977	247.	0.210	0.507	1.000	3.54	2153.	1402.	17.88
	1912.	0.894	0.000	0.000	13.65	14.80				
	0.934	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002

88.0	1344.	1.099	241.	0.192	0.464	1.000	3.51	2045.	1343.	17.04
	1508.	0.979	0.000	0.000	13.65	15.14				
	0.913	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
86.0	1123.	1.125	236.	0.193	0.475	1.000	3.10	1942.	1250.	16.23
	1301.	0.971	0.000	0.000	13.65	14.98				
	0.892	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
84.0	916.	1.168	230.	0.192	0.489	1.000	2.72	1843.	1160.	15.44
	1097.	0.976	0.000	0.000	13.65	14.72				
	0.871	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
82.0	717.	1.248	225.	0.188	0.502	1.000	2.37	1748.	1076.	14.68
	896.	0.998	0.000	0.000	13.65	14.36				
	0.851	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
80.0	519.	1.417	219.	0.177	0.507	1.000	2.06	1658.	996.	13.95
	696.	1.057	0.000	0.000	13.65	13.83				
	0.830	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
78.0	321.	1.846	214.	0.156	0.486	1.000	1.77	1571.	920.	13.24
	492.	1.204	0.000	0.000	13.65	13.05				
	0.809	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0003
76.0	118.	3.934	208.	0.113	0.354	1.000	1.51	1489.	850.	12.56
	279.	1.664	0.000	0.000	13.65	11.78				
	0.788	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
74.0	-98.	-3.585	203.	0.023	-2.361	1.000	1.28	1411.	783.	11.90
	42.	8.302	0.000	0.000	13.65	9.42				
	0.768	0.0011	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0003

SEA-LEVEL STATIC THRUST = 9065. (MAX)
SEA-LEVEL SFC = 0.364
CALLING MODULE NUMBER 6

WEIGHT STATEMENT - BOMBERS
*** WEIGHTS DATA ***
ACSYNT MODULE NUMBER 6

COMPONENT	POUNDS	KILOGRAMS	PERCENT
AIRFRAME STRUCTURE	12921.	5861.	27.42
WING	5212.	2364.	11.06
FUSELAGE	4454.	2020.	9.45
HORIZONTAL TAIL	457.	207.	0.97
VERTICAL TAIL	436.	198.	0.93
NACELLES	805.	365.	1.71
ALIGHTING GEAR	1556.	706.	3.30
PROPULSION	3577.	1623.	7.59
ENGINES (2)	3169.	1438.	6.73
FUEL SYSTEM	408.	185.	0.87
FIXED EQUIPMENT	5179.	2349.	10.99
HYD. + PNEU.	297.	135.	0.63
ELECTRICAL	693.	314.	1.47
AVIONICS	1602.	727.	3.40
INSTRUMENTATION	170.	77.	0.36
DE-ICE/AIR CONDITION	377.	171.	0.80
AUXILIARY GEAR	165.	75.	0.35
FURNISH. + EQPT.	465.	211.	0.99
FLIGHT CONTROLS	1411.	640.	3.00
FUEL	11443.	5191.	24.28
PAYLOAD	14000.	6350.	29.71
FLIGHT CREW (1)	240.	109.	0.51
ARMAMENT	0.	0.	0.00
AMMUNITION	1000.	454.	2.12
MISSILES	0.	0.	0.00
BOMBS	1848.	838.	3.92
EXTERNAL TANKS	0.	0.	0.00
ADV. WEAPONS 1	0.	0.	0.00
ADV. WEAPONS 2	0.	0.	0.00
CALCULATED WEIGHT	47121.	21374.	100.00
ESTIMATED WEIGHT	47117.	21372.	
PERCENT ERROR	0.01		

CALLING MODULE NUMBER 10

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          FINAL VALUES OF NAVY MODULE VARIABLES


         CATAPULT TAKEOFF CALCULATIONS,

           TAKEOFF GROSS WEIGHT = 47117. LBS
              CATAPULT ENDSPEED =160.4 KNOTS
               LIFTOFF ENDSPEED =162.5 KNOTS
            TAKEOFF STALL SPEED = 96.1 KNOTS
         MINIMUM WIND OVER DECK =-56.7 KNOTS
           TAKEOFF ACCELERATION =0.269 G"S
                     TAKEOFF CL =2.832
                     TAKEOFF CD =0.279
         ENGINE OUT CLIMB SPEED = -586.9 FT PER MIN
            TAKEOFF FUEL WEIGHT =11443. LBS
                    TAKEOFF AOA =11.58 DEGS



          ARRESTED LANDING CALCULATIONS

         CARRIER LANDING WEIGHT =36486. LBS
           APPROACH STALL SPEED = 84.6 KNOTS
         MINIMUM APPROACH SPEED =101.5 KNOTS
           CABLE ENGAGING SPEED =145.0 KNOTS
         MINIMUM WIND OVER DECK =-33.3 KNOTS
                     LANDING CL =3.345
                     LANDING CD =0.406
           LANDING RESERVE FUEL = 2660. LBS
         ENGINE OUT CLIMB SPEED =  646.8 FT PER MIN
                    LANDING AOA =11.78 DEGS

                   OTHER CALCULATIONS

         OPERATING EMPTY WEIGHT =22164. LBS
             FOLDED TAIL HEIGHT = 11.5 FEET
                         NERROR = 0
CALLING MODULE NUMBER 11
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SUMMARY --- ACSYNT OUTPUT --- NASA, AMES RESEARCH CENTER

A-10 THUNDERBOLT

GENERAL		FUSELAGE			WING	HTAIL	VTAIL
WG	47121.	LENGTH	53.3	AREA	506.0	118.4	54.1
W/S	93.1	DIAMETER	5.3	WETTED AREA	1012.4	189.0	102.8
T/W	0.38	VOLUME	809.4	SPAN	57.5	18.8	9.7
N(Z) ULT	11.3	WETTED AREA	702.9	L.E. SWEEP	0.0	0.0	4.0
CREW	1.	FINENESS RATIO	10.1	C/4 SWEEP	-1.8	-0.1	-4.0
PASENGERS	0.			ASPECT RATIO	6.54	2.99	1.74
				TAPER RATIO	0.66	0.99	0.61
				T/C ROOT	0.16	0.13	0.13
				T/C TIP	0.13	0.13	0.12
				ROOT CHORD	10.6	6.3	6.9
				TIP CHORD	7.0	6.3	4.2
				M.A. CHORD	8.9	6.3	5.7
				LOC. OF L.E.	22.4	45.4	44.8

ENGINE		WEIGHTS	W	WG
NUMBER	2.			
LENGTH	8.3	STRUCT.	12921.	27.4
DIAM.	3.8	PROPUL.	3577.	7.6
WEIGHT	1478.0	FIX. EQ.	5179.	11.0
TSLS	9065.	FUEL	11443.	24.3
SFCSLS	0.36	PAYLOAD	14000.	29.7

MISSION SUMMARY

PHASE	MACH	ALT	FUEL	TIME	DIST	L/D	THRUST	SFC	Q
TAKEOFF	0.00	0.	345.	7.0	2769.5				
CLIMB	0.50	5000.	104.	0.9	4.9	11.15	11232.9	0.580	310.6
CRUISE	0.50	6164.	2414.	42.5	230.0	11.41	3942.4	0.841	297.4
CRUISE	0.50	298.	506.	7.3	40.0	9.68	4541.1	0.915	366.9
COMBAT	0.60	100.	3794.	30.0	198.4	14.90	11737.4	0.646	531.4
CRUISE	0.50	334.	500.	7.3	40.0	8.42	4368.0	0.940	366.5
CLIMB	0.48	5000.	78.	0.7	3.5	9.96	11354.1	0.569	282.5
CRUISE	0.50	6454.	2345.	42.6	230.0	9.60	3636.0	0.880	294.8
LOITER	0.27	500.	718.	20.0	59.4	13.12	2608.0	0.825	106.1
LANDING					5266.4				

BLOCK TIME = 2.521 HR
BLOCK RANGE = 806.2 NM

COMBAT PHASES

MACH	ALT	PS1G	NZS	CLS	CDS	ALS	NZI	PSI	CLI	CDI	ALI	CBE
0.60	100.	86.	4.0	0.647	0.0435	5.5	7.0	-199.	1.131	0.0913	10.3155192.	

XI. EXAMPLE TWO

A. INTRODUCTION

This example will use the A-10 design developed in the previous example, only a Sensitivity Study will now be performed on it. In particular, the effect that the wing taper and overall compressor pressure ratio have on the aircraft gross weight will be examined. No changes to the aircraft data file other than the Analysis Method will be made. It is assumed that the data file was updated after Example 1 was performed so that the design is now "converged".

B. SENSITIVITY INPUTS

After a decision is made concerning the goals of the analysis, the Global Numbers for the variables must be determined and the desired range for the Sensitivity Variables should be set. The following information comes from Tables 1, 4 and 5:

- Sensitivity Objective: Total Aircraft Weight
  Global Number: 585
- Sensitivity Variable #1: Wing Taper Ratio
  Global Number: 514
  Range: 0.1 - 0.99
- Sensitivity Variable #2: Overall Compressor Press. Ratio
  Global Number: 337
  Range: 16.0 - 25.0

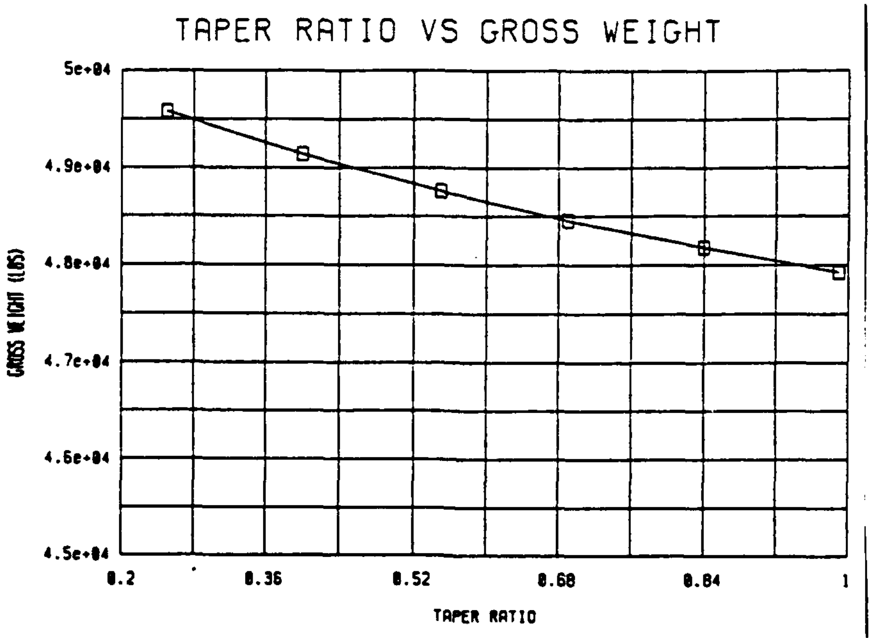
With the information in hand, start CREATE and complete the following steps:

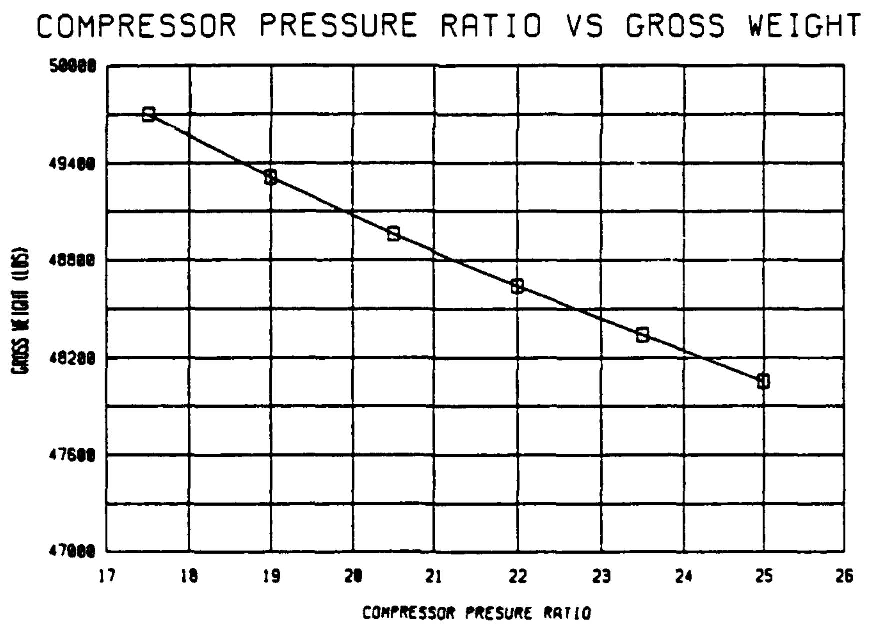
- Start CREATE and open the "A10" data file.
- Select (1), Change Analysis Method
- Select (3), Sensitivity
- Enter a project title of "A-10 Sensitivity Study"
- One Sensitivity Objective
- Sensitivity Objective Global Number: 585
- Two Sensitivity Variables
- Sensitivity Variable #1: 514
- Upper Bound: 0.99
- Lower Bound: 0.1
- Sensitivity Variable #2: 337
- Upper Bound: 25.0
- Lower Bound: 16.0
- Aircraft (3), Bomber
- No change to the Module selection.
- No further changes. Complete CREATE to the end.

Now run ACSYNT again. This analysis will take about 18 minutes. The design is re-converged for each of the 14 variable values (seven values for

each Sensitivity Variable). The output from this study is on the following pages. The first part (pages 114 - 131) is similar to the Simple Analysis and is just to show the initial values. The convergence information starts on page 121.

The results of the Sensitivity Study starts on page 131. The taper ratio is examined first and is in the "X" column, with the corresponding gross weights in the F(X) column. Due to a bug in ACSYNT, the initial values (in this case for taper = 0.5) are not printed, so the first indicated value is 0.58. It is apparent that the gross weight declines slightly as the taper ratio increases (Fig 5). The compressor pressure ratio clearly has a greater impact on the gross weight (Fig 6), brought about by fuel savings. These results are shown graphically on the following page.





6. Sensitivity Study Results

```
AAAAAAA  CCCCCCC  SSSSSSS  Y     Y  N     N  TTTTTTT
A     A  C        S         Y   Y   NN    N     T
A     A  C        S          Y Y    N N   N     T
AAAAAAA  C        SSSSSSS     Y     N  N  N     T
A     A  C              S     Y     N   N N     T
A     A  C              S     Y     N    NN     T
A     A  CCCCCCC  SSSSSSS     Y     N     N     T
```

N A S A - A M E S P R O G R A M

F O R

A I R C R A F T   S Y N T H E S I S

NAVAL POSTGRADUATE SCHOOL VERSION

T I T L E

A-10 SENSITIVITY STUDY

AIRCRAFT TYPE - BOMBER

```
TITLE:
A-10 SENSITIVITY STUDY


AIRCRAFT TYPE - BOMBER


CONTROL PARAMETERS:
READ CONTROL,                            MREAD =    6
EXECUTION CONTROL,                       MEXEC =    4
WRITE CONTROL,                          MWRITE =    6
NUMBER IDENTIFYING CONVERGENCE
  VARIABLE FOR CONVERGED VEHICLE,         IOBJ =  570
NUMBER IDENTIFYING COMPARISON
  VARIABLE FOR CONVERGED VEHICLE,         JOBJ =  585
SUMMARY OUTPUT PRINT CODE,               IPSUM =    1
GLOBAL ERROR PRINT CODE,                KGLOBP =    0
GLOBAL COMMON INITIALIZATION CODE,        INIT =    0
DEBUG PRINT CODE,                        IPDBG =    2
GLOBAL PLOT CONTROL,                     IGPLT =    1
DATA TRANSFER INFORMATION FILE, IRDDTR     =    7
DATA TRANSFER INFORMATION PRINT, IPDTR     =    0


VEHICLE CONVERGENCE INFORMATION:
CONVERGENCE TOLERANCE, TOL = 0.10000E-03
ESTIM WCALC VS WEXT SLOPE  = 0.75000E+00
BOUNDING WEIGHT, WGMAX     = 0.60000E+05


MODULE IDENTIFICATION NUMBERS:

 NUMBER       MODULE
    1         GEOMETRY
    2         TRAJECTORY
    3         AERODYNAMICS
    4         PROPULSION
    5         STABILITY AND CONTROL
    6         WEIGHTS
    8         GLOBAL I/O
   10         NAVY
   11         SUMMARY OUTPUT
   14         TAKEOFF AND LANDING

MODULES ARE CALLED FOR INPUT IN THE FOLLOWING ORDER:
    1    2    3    4    6   10

MODULES ARE CALLED FOR EXECUTION IN THE FOLLOWING ORDER:
    1    2    6  -10

MODULES ARE CALLED FOR OUTPUT IN THE FOLLOWING ORDER:
    1    2    3    4    6   10
CALLING MODULE NUMBER  1
```

```
GEOMETRY DATA CARDS
 1*** GEOMETRY DATA ***
 2 $WING
 3      AR= 6.54,        AREA= 506.00,  DIHED= 7.00,
 4      FDENWG= 48.62, LFLAPC=0.12,    SWEEP=  0.00,
 5      SWFACT=0.99,     TAPER=0.66,    TCROOT=0.16,
 6      TCTIP=0.13,      TFLAPC=0.35,   WFFRAC=0.19,
 7      XWING=0.47,      ZROOT=-1.00,   KSWEEP=0,
 8      OUTCOD=2,
 9      $END
10 $HTAIL
11      AR= 2.99,        AREA= 118.40,  CVHT=1.00,
12      HTFRAC=0.234,    SWEEP= 0.00,   SWFACT=1.10,
13      TAPER=0.99,      TCROOT=0.13,   TCTIP=0.13,
14      XHTAIL=0.97,     ZROOT=0.00,    KSWEEP=0,
15      OUTCOD=2,        SIZIT=F,
16      $END
17 $VTAIL
18      AR= 1.74,        AREA=  54.10,  CVVT=0.10,
19      SWEEP= 0.00,     SWFACT=1.10,   TAPER=0.61,
20      TCROOT=0.13,     TCTIP=0.12,    VTFRAC=0.107,
21      VTNO=2.0,        XVTAIL=0.97,   YROOT=0.00,
22      ZROOT=-.90,      KSWEEP=0,      OUTCOD=2,
23      SIZIT=F,
24      $END
25 $FPOD
26      DIAM=  4.88,     LENGTH= 10.89, SOD= 0.20,
27      THETA= 0.00,     X=0.6,         OUTCOD=2,
28      SYMCOD=0,
29      $END
30 $FUS
31      BDMAX= 5.26,     BODL= 53.33,   DRADAR= 0.00,
32      FRAB= 5.50,      FRATIO= 0.00,  FRN= 1.94,
33      LRADAR= 0.00,    SFFACT= 1.00,  WALL= 0.00,
34      WFUEL= 11443.0,OUTCOD=2,        ITAIL=1,
35      $END
36 $CREW
37      LENGTH=  0.00, WIDTH=  0.00,    NCREW= 1,
38      OUTCOD=2,        TAND=T,
39      $END
40 $FUEL
41      DEN=48.62,       FRAC=1.00,     WFUEL=      0.0,
42      OUTCOD=2,
43      $END

END OF GEOMETRY DATA CARDS
  43 CARDS READ


CREW SEATING REQUIREMENTS
 NUMBER OF CREW...............   1.0
 TANDEM SEATING...............     T
 CREW LENGTH REQUIRED.........   0.0
 CREW WIDTH  REQUIRED.........   3.5
```

NASA/AMES   A C S Y N T   **INITIAL OUTPUT**

FUSELAGE DEFINITION

X	R	AREA
0.00	0.00	0.00
1.07	0.78	1.92
2.13	1.26	4.98
3.20	1.63	8.36
4.27	1.93	11.69
5.33	2.17	14.74
6.40	2.35	17.36
7.47	2.49	19.43
8.53	2.58	20.86
9.60	2.62	21.62
10.67	2.63	21.73
11.73	2.63	21.73
12.80	2.63	21.73
13.87	2.63	21.73
14.93	2.63	21.73
16.00	2.63	21.73
17.07	2.63	21.73
18.13	2.63	21.73
19.20	2.63	21.73
20.27	2.63	21.73
21.33	2.63	21.73
22.40	2.63	21.73
23.47	2.63	21.73
24.53	2.63	21.73
25.60	2.63	21.67
26.67	2.62	21.53
27.73	2.60	21.30
28.80	2.58	20.98
29.86	2.56	20.58
30.93	2.53	20.09
32.00	2.49	19.52
33.06	2.45	18.87
34.13	2.40	18.15
35.20	2.35	17.35
36.26	2.29	16.49
37.33	2.23	15.55
38.40	2.15	14.57
39.46	2.07	13.52
40.53	1.99	12.43
41.60	1.90	11.30
42.66	1.80	10.14
43.73	1.69	8.95
44.80	1.57	7.75
45.86	1.44	6.55
46.93	1.31	5.36
48.00	1.16	4.21
49.06	0.99	3.10
50.13	0.81	2.08
51.20	0.61	1.16
52.26	0.37	0.42
53.33	0.00	0.00

FUSELAGE

MAX. DIAMETER...... 5.260
FINENESS RATIO..... 10.139
SURFACE AREA....... 702.864
VOLUME............. 809.360

NASA/AMES   A C S Y N T   **INITIAL OUTPUT**

DIMENSIONS OF PLANAR SURFACES

	WING	H.TAIL	V.TAIL	CANARD	UNITS
PLAN AREA..........	506.0	118.4	54.1	0.0	(SQ.FT.)
SURFACE AREA.......	1012.4	189.0	102.7	0.0	(SQ.FT.)
VOLUME.............	464.5	67.8	27.1	0.0	(CU.FT.)
SPAN...............	57.526	18.815	9.702	0.000	(FT.)
L.E. SWEEP.........	0.000	0.000	0.000	0.000	(DEG.)
C/4 SWEEP..........	-1.794	-0.096	-3.982	0.000	(DEG.)
T.E. SWEEP.........	-7.140	-0.385	-15.559	0.000	(DEG.)
ASPECT RATIO	6.540	2.990	1.740	0.000	
ROOT CHORD.........	10.598	6.324	6.927	0.000	(FT.)
ROOT THICKNESS.....	20.347	9.866	10.806	0.000	(IN.)
ROOT T/C	0.160	0.130	0.130	0.000	
TIP CHORD..........	6.994	6.261	4.225	0.000	(FT.)
TIP THICKNESS......	10.911	9.767	6.084	0.000	(IN.)
TIP T/C	0.130	0.130	0.120	0.000	
TAPER RATIO	0.660	0.990	0.610	0.000	
MEAN AERO CHORD....	8.919	6.293	5.685	0.000	(FT.)
LE ROOT AT.........	22.416	45.406	44.803	0.000	(FT.)
C/4 ROOT AT........	25.065	46.987	46.535	0.000	(FT.)
TE ROOT AT.........	33.013	51.730	51.730	0.000	(FT.)
LE M.A.C. AT.......	22.416	45.406	44.803	0.000	(FT.)
C/4 M.A.C. AT......	24.645	46.979	46.225	0.000	(FT.)
TE M.A.C. AT.......	31.335	51.699	50.488	0.000	(FT.)
Y M.A.C. AT........	13.400	4.696	4.459	0.000	
LE TIP AT..........	22.416	45.406	44.803	0.000	(FT.)
C/4 TIP AT.........	24.164	46.971	45.860	0.000	(FT.)
TE TIP AT..........	29.410	51.667	49.029	0.000	(FT.)
ELEVATION..........	-2.630	0.000	-2.367	0.000	(FT.)
VOLUME COEFF.		0.586	0.040	0.000	

E X T E N S I O N S

	Strake	Rear Extension
Centroid location at.......	0.000	0.000
Area.......................	0.000	0.000
Wetted Area................	0.000	0.000
Volume.....................	0.000	0.000
Sweep Angle................	0.000	

F U E L   T A N K S

TANK	VOLUME	WEIGHT	DENSITY
WING	84.	4103.	48.62
FUS#1	0.	0.	48.62
FUS#2	0.	0.	50.00
TOTAL		4103.	

MISSION FUEL REQUIRED=   0.

AVAILABLE FUEL VOLUME IN WING=   444.

AIRCRAFT WEIGHT =   0.000 Lbs.
AIRCRAFT VOLUME =   1368.697 Cu.Ft.
AIRCRAFT DENSITY =   0.000 Lbs./Cu.Ft..
CASE= 4
CALLING MODULE NUMBER 2

TRAJECTORY INPUT

```
TIMTO1 = 5.0        MENDUR =     0.     NCRUSE = 4     IPLOT = 0
TIMTO2 = 2.0          QMAX =   700.     IPSIZE =-3     HMINP =      0.
FRFURE = 0.05        XDESC =  80.0      IPSTO1 = 5     HMAXP = 40000.
DESLF =, 7.00       WKFUEL = 1.000      IPSTO2 = 2     DELHP =  4000.
 ULTLF =11.25       CRMACH = 0.450       IBREG = 0    SMMINP = 0.300
 RANGE =   1000.    WKLAND = 0.570      IENDUR = 0    SMMAXP = 0.900
 WFUEL =   11130.    FLFAC = 0.600      IPRINT = 0     DELMP = 0.100
 WFEXT =      0.     DECEL = 0.250      KERROR = 2    WCOMBP =      0.50
WFTRAP =    100.    NLEGCL = 0          NLEGCR = 0    NLEGLO = 0
FWGMAX = 1.200         TOL = 0.001      MILCOM = 0     NMISS = 1
                                                       NCODE = 0
 MMPROP = 1
```

MISSION 1

PHASE	MACH NO. START	MACH NO. END	ALTITUDE START	ALTITUDE END	HORIZONTAL DIST	HORIZONTAL TIME	NO. TURN	VIND "G"S	WKFUEL	M	IP	IX	W	B	A	P
CLIMB	0.00	0.00	100	5000	0.0	0.0	0.0	0.0	1.0000	1	2	0	0	0	0	0
CRUISE	0.50	0.50	5000	-1	230.0	44.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
CRUISE	0.50	0.50	100	-1	40.0	8.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
COMBAT	0.60	0.60	100	-1	0.0	30.0	0.0	5.0	1.0000	1	3	0	0	1	1	0
CRUISE	0.50	0.50	100	-1	40.0	8.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
CLIMB	0.00	0.00	100	5000	0.0	0.0	0.0	0.0	1.0000	1	2	0	0	0	0	0
CRUISE	0.50	0.50	5000	-1	230.0	44.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
LOITER	0.27	0.27	500	-1	10.0	20.0	0.0	0.0	1.0000	1	4	0	0	0	0	0

```
CALLING MODULE NUMBER  3
CALLING MODULE NUMBER  4
```

PROPULSION INPUT
VERSION 04-76

```
*** PROPULSION DATA ***


AENDIA =     4.350  AENLE  =      8.330  AENWT  =  1478.000
ALTI   =     0.000  AM     =      0.000  ATURB  =     0.385
AENTW  =     0.000
AUAENG =     0.000  AWAENG =      0.157  BA     =     6.230
DELPR  =     0.000  DELT57 =    100.000  DEPWCC =     2.000
DIA1   =     3.860  EAB1   =      0.750  EB1    =     0.870
ED1    =     0.750  ETAC1  =      0.800  ETAF1  =     0.900
ETAT1  =     0.920  HTR    =      0.550  HVF    = 18600.000
MACH1  =     1.000  MACH2  =      1.100  PCDFAC =     1.000
POSA   =    29.920  PRFD   =      1.510  PWCC   =   100.000
P11P1  =     1.396  P2P1   =     21.000  R10A   =    -1.000
R32    =     0.970  R54    =      0.920  R54N   =     0.880
R711   =     0.980  R711N  =      0.820  SCPR   =     1.240
SFADP  =     1.000  SFADSP =      1.000  SFAUXP =     1.000
SFBEP  =     1.000  SFBPP  =      1.000  SFBTP  =     1.000
SFDIVP =     1.000  SFINSP =      1.000  SFIP   =     1.000
SFSFC1 =     1.000  SFSFC2 =      1.000  SFSFC3 =     1.000
SM1    =     0.500  SODG   =      2.000  TOSA   =   518.000
TR     =   520.000  TWAB   =     25100.  TWOAB  =     9065.
TWTO   =     0.500  T3     =      2697.  T5M    =     3400.
T51    =        0.  T7M    =      3400.  T71    =        0.
VC1    =     0.980  WCWA1  =      0.000  XMDES  =     0.850
XMT    =     0.850  YREN   =        75.  FRBT   =     0.000
FRPN   =     0.000  RDIAM  =      1.150  RLENG  =     1.307


IPR    =         3  IPRINT =          0  IPLOT  =         0
KERROR =         0  KODE   =          2  KT5    =         0
KT7    =         0  MINPR  =          1  NAB    =         6
NOZZ   =         0  NPROP  =          6  NSUMM  =        15
                                         IENG   =         2 (TF30)


THESE VARIABLES ARE USED BY TABLE LOOK UP
ESF    =     1.000  NDTAIL   = 0  IPDBUG  = 0  IIPRINT = 0


ALTD   =     0.        0.        5000.     5000.     5000.     10000.
XMACH  =   0.000     0.500     0.500     0.570     0.700     0.700
XMPRI  =   0.000     0.300     0.600     0.900     1.200     4.000
XPRI   =   1.000     1.000     1.000     1.000     1.000     1.000
XMPRI1 =     0.000     0.000     0.000     0.000     0.000     0.000     0.000
             0.000     0.000     0.000
XPRI1  =   0.000     0.000     0.000     0.000     0.000     0.000     0.000
           0.000     0.000     0.000
XMPRI2 =     0.000     0.000     0.000     0.000     0.000     0.000     0.000
             0.000     0.000     0.000
XPRI2  =   0.000     0.000     0.000     0.000     0.000     0.000     0.000
           0.000     0.000     0.000
   CALLING MODULE NUMBER  6
```

```
                              INITIAL WEIGHTS INPUT DATA
                              ACSYNT MODULE NUMBER 6
AIRCRAFT TYPE:  BOMBER
TITLE:  *** WEIGHTS DATA ***

CONTROL OPTIONS

    IPRINT =  1   IGRAPH =  1   ITAIL  =  0   KERROR =  0
    IDELT  =  0   IOBLIQ =  0   KWING  =  3   KBODY  =  1
    K1     = 1.00 K2     = 1.00 K3     =  1.0 K4     =  1.0
    K5     = 1.00 K6     = 1.00 AFMACH = 0.70 MAXIT  =  1
    KB     = 0.00 KP1    = 0.00 KP2    = 0.00
    FR     = 1.00 TECHG  = 1.00 WGTO   =   47121.
    STRESS =   30000.           DENS   =  0.056     FLIFTF =0.000
    TECHI  =  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
  SLOPE(1) =  1.10  1.20  1.20  1.00  2.02  0.90  0.90  1.00
  SLOPE(9) =  1.30  1.00  1.00  1.00  1.00  1.00  1.00  1.37  1.00

INITIAL ESTIMATES
 IF CODE = 1, WEIGHT IS FIXED

 QUANTITY      VALUE   CODE            QUANTITY      VALUE   CODE

  WAF    =     12251.   0               WAIRC  =      283.   0
  WAPU   =        0.    0               WAMMUN =     1000.   1
  WARM   =        0.    0               WBAG   =        0.   0
  WBB1   =        0.    0               WBODY  =     5183.   0
  WCAND  =        0.    0               WCARGO =        0.   0
  WCREW  =      283.    0               WE     =     6126.   0
  WELT   =     1979.    0               WEP    =      660.   0
  WETANK =        0.    0               WFEQ   =     5655.   0
  WFS    =      613.    0               WCA    =      660.   0
  WGEAR  =      283.    0               WHDP   =       24.   0
  WHT    =      942.    0               WINST  =      141.   0
  WLG    =     1414.    0               WMISS  =        0.   0
  WNA    =     1131.    0               WPA    =        0.   0
  WPASS  =        0.    0               WPL    =    14000.   1
  WPS    =     6597.    0               WSC    =     1414.   0
  WTSUM  =    47121.    0               WVT    =      424.   0
  WWING  =     3770.    0               WBOMB  =     1848.   1
  WENVP  =        0.    0               WPIV   =        0.   0
  WLIFTF =        0.    0               WBB2   =        0.   0
    CALLING MODULE NUMBER 10


                  INPUT VALUES TO NAVY MODULE

              CLMAX = 1.80
              SIGMA = 0.94449
             VSOUND =  679.6
                ALT =      0.


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.47121E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
```

```
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49355E+05

    SLOPE OF WCALC VS WEST LINE = 0.75000E+00

    ESTIMATED GROSS WEIGHT  = 0.56058E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.51610E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.50109E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.50120E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.50124E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.50122E+05


    * * * END VEHICLE CONVERGENCE


     3 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.50124E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49715E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.48759E+05
    CALLING MODULE NUMBER  1
```

```
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49380E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.49581E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49582E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.49581E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49244E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.48457E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48972E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.49137E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49137E+05


    * * * END VEHICLE CONVERGENCE
```

```
     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.49137E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48852E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.48187E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48624E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.48762E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48762E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.48762E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48532E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47996E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48350E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00
```

```
    ESTIMATED GROSS WEIGHT  = 0.48461E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48460E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT



    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.48461E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48246E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47744E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48078E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.48180E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48179E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT



    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.48180E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
```

```
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47989E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47544E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47843E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.47932E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47933E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT



    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.47932E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49262E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.52366E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.50361E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.49700E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49699E+05


    * * * END VEHICLE CONVERGENCE
```

```
     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.49700E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49409E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.48729E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49164E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.49311E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49312E+05


    * * * END VEHICLE CONVERGENCE

     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.49311E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49049E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.48438E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6
```

```
    CALCULATED GROSS WEIGHT = 0.48832E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.48962E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48960E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.48962E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48720E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.48156E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48517E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.48639E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48638E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE
```

```
    ESTIMATED GROSS WEIGHT  = 0.48639E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48411E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47879E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48223E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.48336E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48336E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT



    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.48336E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.48118E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47608E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47937E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.48045E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6
```

```
CALCULATED GROSS WEIGHT = 0.48047E+05

* * * END VEHICLE CONVERGENCE

 2 CONVERGENCE ITERATIONS REQUIRED
CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT
```

STANDARD SENSITIVITY ANALYSIS RESULTS (NCALC=3)

TITLE
A-10 SENSITIVITY STUDY

NUMBER OF SENSITIVITY VARIABLES, NSV = 2
NUMBER OF SENSITIVITY OBJECTIVES, NSOBJ = 1

GLOBAL NUMBERS ASSOCIATED WITH SENSITIVITY VARIABLES
514 337

GLOBAL NUMBERS ASSOCIATED WITH SENSITIVITY OBJECTIVES
585

NOMINAL DESIGN INFORMATION

VALUES OF SENSITIVITY VARIABLES
0.10000E+00 0.16000E+02

VALUES OF SENSITIVITY OBJECTIVE FUNCTIONS
0.50122E+05

SENSITIVITY ANALYSIS RESULTS

GLOBAL VARIABLE 514

X	F(X)
0.2500E+00	0.4958E+05
0.4000E+00	0.4914E+05
0.5500E+00	0.4876E+05
0.6900E+00	0.4846E+05
0.8400E+00	0.4818E+05
0.9900E+00	0.4793E+05

GLOBAL VARIABLE 337

X	F(X)
0.1750E+02	0.4970E+05
0.1900E+02	0.4931E+05
0.2050E+02	0.4896E+05
0.2200E+02	0.4864E+05
0.2350E+02	0.4834E+05
0.2500E+02	0.4805E+05

XII. EXAMPLE THREE

A. OVERVIEW

This example will demonstrate the use of the Optimization Method of analysis. The goal of this exercise is to reduce the take-off gross weight by reducing the wing reference area, subject to a constraint on the turning rate during combat. In this case, a hypothetical contract for the aircraft under development specifies a minimum turning rate of 10 degrees per second while delivering weapons.

B. OPTIMIZATION INPUTS

The following inputs will be needed for this analysis:

- Objective Variable: Total Aircraft Weight
  Global Number: 585
- Design Variable #1: Wing Reference Area.
  Global Number: 422
  Range: 300.0 - 800.0 ft^2
- Constraint #1: Sustained Turning Rate, Phase 4 (combat)
  Global Number: 450
  Range: 10.0 - 12.0 deg/s

Use the following procedure:

- Start CREATE and open the A10 data file.

- Change the Analysis Method to (2) Optimization
- Title: A-10 Optimization Study
- Objective Variable Global Number: 585
- Minimize
- 1 Design Variable
- Design Variable #1 Global Number: 422
- Upper Bound: 800.0
- Lower Bound: 300.0
- 1 Constraint
- Constraint #1 Global Number: 450
- Upper Bound: 12.0 deg/s
- Lower Bound: 10.0 deg/s
- Aircraft Type: Bomber
- Proceed through the rest of CREATE without changes.

This run will take approximately 15 minutes. The output is quite long for the Optimization Method. The first part of the output is a complete convergence run using a starting value (provided by CREATE) for the design variable and has been omited here for the sake of brevity. The Optimization process begins with the model converged using a wing area of 550 square feet. ACSYNT then proceeds to determine the minimum weight achievable within the given constraint. The final values are shown on page 144. The weight is

46068 lbs with a wing area of 387.54 square feet, giving a turning radius of 9.998 degrees/second. Compare this to the original weight of 47121 lbs. A final printout is then made using this new wing area.

Obviously, this minimum wing area should be taken with a grain of salt. While ACSYNT can perform the mission given with this wing, it does not take into account the real-world requirements (such as bomb station spacing). The A-10 also has additional wing area built in as a survivability enhancement feature. ACSYNT is only concerned with satisfying the mission trajectory.

```
* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
*                   C O N M I N                     *
*                                                   *
*               FORTRAN PROGRAM FOR                 *
*                                                   *
*        CONSTRAINED FUNCTION MINIMIZATION          *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *


    INITIAL FUNCTION INFORMATION

    OBJ =    0.477200E+05


    DECISION VARIABLES (X-VECTOR)
      1)    0.55000E+03


    CONSTRAINT VALUES (G-VECTOR)
      1)   -0.77487E-01 -0.10209E+00


    * * * BEGIN VEHICLE CONVERGENCE


    ESTIMATED GROSS WEIGHT  = 0.47718E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47802E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47997E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47871E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.47830E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47831E+05


    * * * END VEHICLE CONVERGENCE
```

```
     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.47830E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47319E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.46127E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46915E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.47160E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.47158E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.47160E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45679E+05
```

```
    SLOPE OF WCALC VS WEST LINE = 0.70000E+00


    ESTIMATED GROSS WEIGHT  = 0.42222E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.44317E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.45115E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45103E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.45099E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45100E+05


    * * * END VEHICLE CONVERGENCE


     3 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10



    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.45099E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45840E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47570E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6


    CALCULATED GROSS WEIGHT = 0.46449E+05


    SLOPE OF WCALC VS WEST LINE = 0.30000E+00
```

```
    ESTIMATED GROSS WEIGHT  = 0.46082E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46084E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10


INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT


    * * * BEGIN VEHICLE CONVERGENCE


    ESTIMATED GROSS WEIGHT  = 0.46082E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46146E+05


    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.46293E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46195E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.46165E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46167E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED

    CALLING MODULE NUMBER 10


INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT
```

```
    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.46165E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45398E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.43610E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.44694E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.45107E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45102E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.45099E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45100E+05

    * * * END VEHICLE CONVERGENCE

     3 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10

    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.45099E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45165E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00
```

```
    ESTIMATED GROSS WEIGHT  = 0.45317E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45226E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.45191E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45191E+05


    * * * END VEHICLE CONVERGENCE


     2 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER 10



    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.45191E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.45849E+05

    SLOPE OF WCALC VS WEST LINE = 0.70000E+00

    ESTIMATED GROSS WEIGHT  = 0.47384E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46393E+05

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.46066E+05
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.46068E+05


    * * * END VEHICLE CONVERGENCE
```

```
 2 CONVERGENCE ITERATIONS REQUIRED
CALLING MODULE NUMBER 10


INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT



* * * BEGIN VEHICLE CONVERGENCE


ESTIMATED GROSS WEIGHT  = 0.46066E+05
CALLING MODULE NUMBER  1
CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
CALLING MODULE NUMBER  6

CALCULATED GROSS WEIGHT = 0.46129E+05

SLOPE OF WCALC VS WEST LINE = 0.70000E+00


ESTIMATED GROSS WEIGHT  = 0.46277E+05

CALLING MODULE NUMBER  1
CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
CALLING MODULE NUMBER  6


CALCULATED GROSS WEIGHT = 0.46180E+05


SLOPE OF WCALC VS WEST LINE = 0.30000E+00


ESTIMATED GROSS WEIGHT  = 0.46149E+05
CALLING MODULE NUMBER  1
CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
CALLING MODULE NUMBER  6


CALCULATED GROSS WEIGHT = 0.46149E+05



* * * END VEHICLE CONVERGENCE


 2 CONVERGENCE ITERATIONS REQUIRED

CALLING MODULE NUMBER 10


INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT
```

```
  FINAL OPTIMIZATION INFORMATION

   OBJ =    0.460680E+05


   DECISION VARIABLES (X-VECTOR)
     1)    0.38754E+03


   CONSTRAINT VALUES (G-VECTOR)
     1)    0.10319E-03 -0.16675E+00


   THERE ARE    1 ACTIVE CONSTRAINTS
   CONSTRAINT NUMBERS ARE
       1


   THERE ARE    0 VIOLATED CONSTRAINTS

   THERE ARE    0 ACTIVE SIDE CONSTRAINTS


   TERMINATION CRITERION
        ABS(OBJ(I)-OBJ(I-1))   LESS THAN DABFUN FOR  3 ITERATIONS

   NUMBER OF ITERATIONS =     4

   OBJECTIVE FUNCTION WAS EVALUATED           10   TIMES


   CONSTRAINT FUNCTIONS WERE EVALUATED        10   TIMES


   * * * BEGIN VEHICLE CONVERGENCE

   ESTIMATED GROSS WEIGHT  = 0.46149E+05
   CALLING MODULE NUMBER  1
   CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
   CALLING MODULE NUMBER  6

   CALCULATED GROSS WEIGHT = 0.46087E+05

   SLOPE OF WCALC VS WEST LINE = 0.70000E+00

   ESTIMATED GROSS WEIGHT  = 0.45943E+05
   CALLING MODULE NUMBER  1
   CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
   CALLING MODULE NUMBER  6

   CALCULATED GROSS WEIGHT = 0.46038E+05

   SLOPE OF WCALC VS WEST LINE = 0.30000E+00

   ESTIMATED GROSS WEIGHT  = 0.46068E+05
   CALLING MODULE NUMBER  1
   CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of    5.000000
   CALLING MODULE NUMBER  6
```

```
CALCULATED GROSS WEIGHT = 0.46068E+05

* * * END VEHICLE CONVERGENCE

 2 CONVERGENCE ITERATIONS REQUIRED
CALLING MODULE NUMBER 10

INSUFFICIENT THRUST IF ENGINE LOST OFF CATAPULT
```

OPTIMIZATION RESULTS

OBJECTIVE FUNCTION
GLOBAL LOCATION 585 FUNCTION VALUE 0.46068E+05

DESIGN VARIABLES

ID	D. V. NO.	GLOBAL VAR. NO.	LOWER BOUND	VALUE	UPPER BOUND
1	1	422	0.30000E+03	0.38754E+03	0.80000E+03

DESIGN CONSTRAINTS

ID	GLOBAL VAR. NO.	LOWER BOUND	VALUE	UPPER BOUND
1	450	0.10000E+02	0.99985E+01	0.12000E+02

```
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
WARNING : Combat load factor reduced from input value of     5.000000
    CALLING MODULE NUMBER  6
    CALLING MODULE NUMBER  1
```

NASA/AMES A C S Y N T **FINAL OUTPUT**

FUSELAGE DEFINITION

X	R	AREA
0.00	0.00	0.00
1.07	0.78	1.92
2.13	1.26	4.98
3.20	1.63	8.36
4.27	1.93	11.69
5.33	2.17	14.74
6.40	2.35	17.36
7.47	2.49	19.43
8.53	2.58	20.86
9.60	2.62	21.62
10.67	2.63	21.73
11.73	2.63	21.73
12.80	2.63	21.73
13.87	2.63	21.73
14.93	2.63	21.73
16.00	2.63	21.73
17.07	2.63	21.73
18.13	2.63	21.73
19.20	2.63	21.73
20.27	2.63	21.73
21.33	2.63	21.73
22.40	2.63	21.73
23.47	2.63	21.73
24.53	2.63	21.73
25.60	2.63	21.67
26.67	2.62	21.53
27.73	2.60	21 30
28.80	2.58	20.98
29.86	2.56	20.58
30.93	2.53	20.09
32.00	2.49	19.52
33.06	2.45	18.87
34.13	2.40	18.15
35.20	2.35	17.35
36.26	2.29	16.49
37.33	2.23	15.55
38.40	2.15	14.57
39.46	2.07	13.52
40.53	1.99	12.43
41.60	1.90	11.30
42.66	1.80	10.14
43.73	1.69	8.95
44.80	1.57	7.75
45.86	1.44	6.55
46.93	1.31	5.36
48.00	1.16	4.21
49.06	0.99	3.10
50.13	0.81	2.08
51.20	0.61	1.16
52.26	0.37	0.42
53.33	0.00	0.00

NACELLE DEFINITION

X-XNOSE	R	AREA
0.00	2.18	14.92
2.72	2.18	14.92
8.17	2.18	14.92
10.89	2.18	14.92

NACELLE LOCATION

X	Y	Z
32.00	5.25	0.00
32.00	-5.25	0.00

	FUSELAGE		**PODS**
MAX. DIAMETER......	5.260	.....	4.359
FINENESS RATIO.....	10.139		
SURFACE AREA.......	702.864	.....	149.095 (EACH)
VOLUME.............	809.360		

NASA/AMES A C S Y N T **FINAL OUTPUT**
DIMENSIONS OF PLANAR SURFACES

	WING	H.TAIL	V.TAIL	CANARD	UNITS
PLAN AREA..........	387.5	118.4	54.1	0.0	(SQ.FT.)
SURFACE AREA.......	775.4	189.0	102.7	0.0	(SQ.FT.)
VOLUME.............	311.3	67.8	27.1	0.0	(CU.FT.)
SPAN...............	50.344	18.815	9.702	0.000	(FT.)
L.E. SWEEP.........	0.000	0.000	0.000	0.000	(DEG.)
C/4 SWEEP..........	-1.794	-0.096	-3.982	0.000	(DEG.)
T.E. SWEEP.........	-7.140	-0.385	-15.559	0.000	(DEG.)
ASPECT RATIO	6.540	2.990	1.740	0.000	
ROOT CHORD.........	9.275	6.324	6.927	0.000	(FT.)
ROOT THICKNESS.....	17.807	9.866	10.806	0.000	(IN.)
ROOT T/C	0.160	0.130	0.130	0.000	
TIP CHORD..........	6.121	6.261	4.225	0.000	(FT.)
TIP THICKNESS......	9.549	9.767	6.084	0.000	(IN.)
TIP T/C	0.130	0.130	0.120	0.000	
TAPER RATIO	0.660	0.990	0.610	0.000	
MEAN AERO CHORD....	7.805	6.293	5.685	0.000	(FT.)
LE ROOT AT.........	22.746	45.406	44.803	0.000	(FT.)
C/4 ROOT AT........	25.065	46.987	46.535	0.000	(FT.)
TE ROOT AT.........	32.021	51.730	51.730	0.000	(FT.)
LE M.A.C. AT.......	22.746	45.406	44.803	0.000	(FT.)
C/4 M.A.C. AT......	24.698	46.979	46.225	0.000	(FT.)
TE M.A.C. AT.......	30.552	51.699	50.488	0.000	(FT.)
Y M.A.C. AT........	11.727	4.696	4.459	0.000	
LE TIP AT..........	22.746	45.406	44.803	0.000	(FT.)
C/4 TIP AT.........	24.277	46.971	45.860	0.000	(FT.)
TE TIP AT..........	28.868	51.667	49.029	0.000	(FT.)
ELEVATION..........	-2.630	0.000	-2.367	0.000	(FT.)
VOLUME COEFF.		0.872	0.060	0.000	

E X T E N S I O N S

	Strake	Rear Extension
Centroid location at.......	0.000	0.000
Area.......................	0.000	0.000
Wetted Area................	0.000	0.000
Volume.....................	0.000	0.000
Sweep Angle................	0.000	

F U E L T A N K S

TANK	VOLUME	WEIGHT	DENSITY
WING	57.	2750.	48.62
FUS#1	179.	8689.	48.62
FUS#2	0.	0.	50.00
TOTAL		11438.	

MISSION FUEL REQUIRED= 11438.

AVAILABLE FUEL VOLUME IN WING= 298.

AIRCRAFT WEIGHT = 46067.734 Lbs.
AIRCRAFT VOLUME = 1215.551 Cu.Ft.
AIRCRAFT DENSITY = 37.899 Lbs./Cu.Ft.
CASE= 4

CALLING MODULE NUMBER 2

TRAJECTORY OUTPUT

MISSION 1 (PAYLOAD = 14000. LB)

PHASE	M SFC(I) SFC(U)	H THRUST(I) THRUST(U)	CL CD CDINST	ALPHA GAMMA L/D	WFUEL W THR/THA	TIME WA PR	VEL Q X
CLIMB	0.53	5000.	0.3494	2.81	99.3	0.87	576.
	0.59	11118.	0.0308	8.89	45623.4	311.98	340.
CYCLE	0.58	0.	0.0012	11.34	2.00	1.00	5.
CRUISE	0.50	5000.	0.3686	3.01	2412.6	42.46	549.
	0.90	3778.	0.0317	0.00	43210.8	254.79	308.
CYCLE	0.86	3925.	0.0012	11.64	0.67	1.00	230.
CRUISE	0.50	100.	0.3004	2.42	495.2	7.26	558.
	0.98	4164.	0.0292	0.00	42715.6	298.70	369.
CYCLE	0.94	4335.	0.0012	10.29	0.65	1.00	40.
COMBAT	0.60	100.	0.7751	6.41	3794.1	30.00	670.
	0.65	11741.	0.0567	0.00	36073.5	356.43	531.
CYCLE	0.63	12018.	0.0013	13.68	1.94	1.00	198.
CRUISE	0.50	100.	0.2506	2.00	471.3	7.26	558.
	0.98	3966.	0.0277	0.00	35602.2	296.53	369.
CYCLE	0.94	4143.	0.0012	9.04	0.62	1.00	40.
CLIMB	0.51	5000.	0.2721	2.17	73.3	0.65	563.
	0.59	11178.	0.0283	12.39	35528.9	309.69	324.
CYCLE	0.58	0.	0.0012	9.62	2.00	1.00	3.
CRUISE	0.50	5000.	0.2844	2.28	2341.3	42.46	549.
	0.96	3425.	0.0287	0.00	33187.6	253.66	308.
CYCLE	0.92	3569.	0.0012	9.92	0.61	1.00	230.
LOITER	0.27	500.	0.8075	7.59	766.3	20.00	301.
	0.82	2791.	0.0678	0.00	32421.3	250.65	106.
CYCLE	0.81	2835.	0.0011	11.90	0.38	1.00	59.

FUEL SUMMARIES

MISSION FUEL =	10798.
RESERVE FUEL =	540.
TRAPPED FUEL =	100.
TOTAL FUEL =	11438.

TAKEOFF FUEL
WFTO1 = 120.
WFTO2 = 225.

FUEL CARRIED :
EXTERNALLY = 0.
INTERNALLY = 11438.

ADDITIONAL COMBAT PARAMETERS

	CONDITIONS	PS	NZ	TDOT	RADIUS	ALPHA	CL	CD
M= 0.60	1 G FLIGHT	98.8	1.00	0.00	0.	1.55	0.207	0.0264
H= 100.	SUSTAINED	0.0	3.77	10.00	3837.	6.41	0.775	0.0567
	MAX. INST.	-550.2	5.96	16.17	2372.	11.00	1.225	0.2264
	COMBAT ENERGY = 0.177918E+06							

BLOCK TIME =	2.516	HOURS
BLOCK RANGE =	806.2	N. M.
TAKEOFF FIELD LENGTH(TOTAL RUN) =	3268.	FEET
LANDING FIELD LENGTH(TOTAL RUN) =	6438.	FEET
LANDING FIELD LENGTH(GROUND RUN) =	2193.	FEET
WEIGHT FOR LANDING CALCULATION =	39605.	POUNDS
LANDING THRUST TO WEIGHT RATIO =	0.485	
TAKEOFF WEIGHT =	46068.	POUNDS
LANDING WEIGHT =	32421.	POUNDS

CALLING MODULE NUMBER 3

Detailed Aerodynamics Output

Mach = 0.20
Altitude = 0.

Parasite Drag		Induced Drag								
Friction	.0190	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0042	0.0	0.005	0.0306	0.2	0.048	0.00	0.0000	0.0	2
Wing	.0079	3.0	0.338	0.0368	9.2	-.037	0.89	0.0000	0.0	2
Strakes	.0000	6.0	0.644	0.0541	11.9	-.122	0.86	0.0000	0.0	2
H. Tail	.0019	0.0	0.005	0.0306	0.2	0.048	0.00	0.0000	0.0	2
V. Tail	.0021	9.0	0.930	0.0810	11.5	-.208	0.84	0.0000	0.0	2
Canard	.0000	12.0	1.205	0.1173	10.3	-.298	0.82	0.0000	0.0	2
Pods	.0028	15.0	1.475	0.1632	9.0	-.391	0.80	0.0000	0.0	2
Engine	.0000	18.0	1.747	0.2196	8.0	-.489	0.79	0.0000	0.0	2
Cowl	.0000	21.0	2.026	0.2878	7.0	-.589	0.78	0.0000	0.0	2
Boattail	.0000	24.0	2.301	0.3657	6.3	-.686	0.77	0.0000	0.0	2
Interference	.0059									
Wave	.0000									
External	.0057									
Tanks	.0000									
Bombs	.0000									

Slope Factors

ClAlpha	0.0957
Cdl^.5Alpha	0.0241

Stores	.0000
Extra	.0057
Camber	.0000
Cdmin	.0306

Mach = 0.30
Altitude = 0.

Parasite Drag	
Friction	.0189
Body	.0042
Wing	.0078
Strakes	.0000
H. Tail	.0019
V. Tail	.0021
Canard	.0000
Pods	.0028
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0059
Wave	.0000
External	.0057
Tanks	.0000
Bombs	.0000
Stores	.0000
Extra	.0057
Camber	.0000
Cdmin	.0305

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.005	0.0305	0.2	0.047	0.00	0.0000	0.0	2
3.0	0.345	0.0369	9.3	-.042	0.90	0.0000	0.0	2
6.0	0.655	0.0546	12.0	-.130	0.87	0.0000	0.0	2
0.0	0.005	0.0305	0.2	0.047	0.00	0.0000	0.0	2
9.0	0.945	0.0821	11.5	-.219	0.84	0.0000	0.0	2
12.0	1.222	0.1190	10.3	-.311	0.82	0.0000	0.0	2
15.0	1.492	0.1654	9.0	-.407	0.80	0.0000	0.0	2
18.0	1.762	0.2220	7.9	-.506	0.79	0.0000	0.0	2
21.0	2.041	0.2909	7.0	-.608	0.78	0.0000	0.0	2
24.0	2.239	0.9546	2.3	-.796	0.26	0.0000	0.0	3

Slope Factors

ClAlpha	0.0931
Cdl^.5Alpha	0.0401

Detailed Aerodynamics Output

Mach = 0.60
Altitude = 5000.

Parasite Drag	
Friction	.0183
Body	.0041
Wing	.0076
Strakes	.0000
H. Tail	.0019
V. Tail	.0020
Canard	.0000
Pods	.0027
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0059
Wave	.0000
External	.0000
Tanks	.0000
Bombs	.0000
Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0242

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.005	0.0242	0.2	0.047	0.00	0.0000	0.0	2
3.0	0.386	0.0320	12.1	-.057	0.94	0.0000	0.0	2
6.0	0.730	0.0529	13.8	-.157	0.90	0.0000	0.0	2
0.0	0.005	0.0242	0.2	0.047	0.00	0.0000	0.0	2
9.0	1.041	0.0844	12.3	-.258	0.88	0.0000	0.0	2
12.0	1.283	0.2572	5.0	-.379	0.34	0.0000	0.0	3
15.0	1.503	0.3789	4.0	-.495	0.31	0.0000	0.0	3
18.0	1.704	0.5252	3.2	-.618	0.28	0.0000	0.0	3
21.0	1.882	0.6933	2.7	-.748	0.26	0.0000	0.0	3
24.0	2.022	0.8750	2.3	-.878	0.23	0.0000	0.0	3

Slope Factors

ClAlpha	0.0841
Cdl^.5Alpha	0.0384

Mach = 0.70
Altitude = 5000.

Parasite Drag	
Friction	.0180
Body	.0040
Wing	.0075
Strakes	.0000
H. Tail	.0018
V. Tail	.0020
Canard	.0000
Pods	.0027
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0059
Wave	.0000
External	.0000
Tanks	.0000
Bombs	.0000
Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0240

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.005	0.0240	0.2	0.047	0.00	0.0000	0.0	2
3.0	0.414	0.0327	12.7	-.064	0.96	0.0000	0.0	2
6.0	0.779	0.0559	13.9	-.170	0.92	0.0000	0.0	2
0.0	0.005	0.0240	0.2	0.047	0.00	0.0000	0.0	2
9.0	1.100	0.1739	6.3	-.288	0.39	0.0000	0.0	3
12.0	1.331	0.2738	4.9	-.401	0.35	0.0000	0.0	3
15.0	1.557	0.4020	3.9	-.522	0.31	0.0000	0.0	3
18.0	1.675	0.5792	2.9	-.614	0.25	0.0000	0.0	4
21.0	1.778	0.7240	2.5	-.740	0.22	0.0000	0.0	4
24.0	1.859	0.8785	2.1	-.867	0.20	0.0000	0.0	4

Slope Factors

ClAlpha	0.0772
Cdl^.5Alpha	0.0385

CALLING MODULE NUMBER 4

```
ENGINE SUMMARY


ENGINE DIAMETER =   4.35 FEET
ENGINE LENGTH=  8.33 FEET
ENGINE WEIGHT=  1478.00 POUNDS
BYPASS RATIO =  6.23
NO OF ENGINES PER AC =   2.
A/C DRAG REF AREA =   387.54 SQ FEET
INLET CAPTURE AREA PER ENG =    6.190 SQ FEET
PWCC    = PERCENT OF ENGINE CORRECTED AIRFLOW
THRUST = ENGINE THRUST (POUNDS PER ENGINE)
SFC     = ENGINE SPECIFIC FUEL CONSUMPTION
WTOT    = ENGINE TOTAL AIRFLOW (LBS/SEC PER ENGINE)
OV EF   = ENGINE OVERALL EFFICIENCY
PR EF   = ENGINE PROPULSIVE EFFICIENCY
TPR     = INLET TOTAL PRESSURE RECOVERY (TO EN FACE)
NPR     = NOZZLE PRESSURE RATIO
TIT     = TURBINE INLET TEMPERATURE (DEG R)
EGT     = ENGINE EXHAUST GAS TEMPERATURE
CPR     = OVERALL COMPRESSOR PRESSURE RATIO
THRUSTU= THRUST PER ENGINE IN LBS, W/O INSTAL DRAG CORR
SFCU    = SFC,1/HR, W/O INSTALLATION DRAG CORR
ABYAC   = FREESTREAM BYPASS FLOW AREA/AC
ABLAC   = FREESTREAM INLET BLEED FLOW AREA/AC
ANOZ    = AREA OF NOZZLE EXIT, FT**2
BETA    = NOZZLE BOATTAIL ANGLE IN DEGREES
AO/AC   = FREE STREAM TO CAPTURE AREA RATIO
CDINS   = TOT INSTALLATION DRAG COEF PER A/C (SWING REF)
CDADD   = ADDITIVE DRAG COEF PER A/C (SWING REF)
CDSP    = SUBSONIC SPILL DRAG COEFF PER A/C (SWING REF)
CDBL    = INLET BLEED DRAG COEF PER A/C (SWING REF)
CDBP    = INLET BYPASS DRAG PER A/C (SWING REF)
CDAUX   = AUX AIR SYSTEM DRAG COEF PER A/C (SWING REF)
CDDIV   = INLET BO. LAYER DIVERT DRAG PER A/C (SWING REF)
CDBT    = NOZZLE BOATTAIL DRAG COEF PER A/C (SWING REF)
CDINF   = DRAG COEF OF BASE AREA BETWEEN NOZZLES (PER A/C)

 INSTALL DRAG COEF SCALE FACTORS
SFINSP =      1.0000
SFADP  =      1.0000
SFADSP =      1.0000
SFBEP  =      1.0000
SFBPP  =      1.0000
SFAUXP =      1.0000
SFDIVP =      1.0000
SFIP   =      1.0000
SFBTP  =      1.0000
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MACH = 0.000 ALTITUDE = 0.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	9065.	0.364	290.	0.000	0.000	1.000	1.79	2697.	1540.	22.49
	9065.	0.364	0.000	0.000	13.65	11.17				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
98.0	8298.	0.355	285.	0.000	0.000	1.000	1.84	2570.	1486.	21.51
	8298.	0.355	0.000	0.000	13.65	11.84				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
96.0	7495.	0.348	279.	0.000	0.000	1.000	1.92	2447.	1441.	20.56
	7495.	0.348	0.000	0.000	13.65	12.66				
	1000.000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000
94.0	6619.	0.348	273.	0.000	0.000	1.000	2.05	2329.	1405.	19.64
	6619.	0.348	0.000	0.000	13.65	13.59				
	1000.000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000
92.0	5582.	0.362	267.	0.000	0.000	1.000	2.25	2214.	1380.	18.75
	5582.	0.362	0.000	0.000	13.65	14.62				
	1000.000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000
90.0	4076.	0.431	261.	0.000	0.000	1.000	2.54	2105.	1367.	17.88
	4076.	0.431	0.000	0.000	13.65	15.69				
	1000.000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000
88.0	2118.	0.717	256.	0.000	0.000	1.000	2.52	1999.	1310.	17.04
	2118.	0.717	0.000	0.000	13.65	16.01				
	1000.000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000
86.0	1872.	0.694	250.	0.000	0.000	1.000	2.22	1898.	1218.	16.23
	1872.	0.694	0.000	0.000	13.65	15.68				
	1000.000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000
84.0	1624.	0.677	244.	0.000	0.000	1.000	1.95	1802.	1131.	15.44
	1624.	0.677	0.000	0.000	13.65	15.20				
	1000.000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000
82.0	1375.	0.668	238.	0.000	0.000	1.000	1.70	1709.	1049.	14.68
	1375.	0.668	0.000	0.000	13.65	14.49				
	1000.000	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000

80.0	1114.	0.678	232.	0.000	0.000	1.000	1.48	1621.	971.	13.95
	1114.	0.678	0.000	0.000	13.65	13.36				
	1000.000	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0000
78.0	827.	0.735	226.	0.000	0.000	1.000	1.27	1536.	897.	13.24
	827.	0.735	0.000	0.000	13.65	11.28				
	1000.000	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0000
76.0	458.	1.039	221.	0.000	0.000	1.000	1.09	1456.	828.	12.56
	458.	1.039	0.000	0.000	13.65	5.40				
	1000.000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000

MACH = 0.500 ALTITUDE = 0.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	6143.	0.594	336.	0.237	0.622	1.000	1.79	2697.	1479.	22.49
	6231.	0.586	0.000	0.000	13.65	9.83				
	1.270	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0005
98.0	5867.	0.619	329.	0.228	0.588	1.000	2.20	2697.	1572.	21.51
	5956.	0.610	0.000	0.000	13.65	11.79				
	1.244	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0004
96.0	5127.	0.630	323.	0.224	0.586	1.000	2.30	2570.	1526.	20.56
	5216.	0.619	0.000	0.000	13.65	12.55				
	1.219	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0004
94.0	4349.	0.655	316.	0.216	0.571	1.000	2.46	2446.	1488.	19.64
	4439.	0.642	0.000	0.000	13.65	13.39				
	1.194	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0003
92.0	3509.	0.712	309.	0.200	0.533	1.000	2.70	2326.	1460.	18.75
	3599.	0.694	0.000	0.000	13.65	14.32				
	1.168	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
90.0	2546.	0.854	302.	0.168	0.451	1.000	3.04	2211.	1445.	17.88
	2637.	0.825	0.000	0.000	13.65	15.30				
	1.143	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0002
88.0	1917.	0.981	296.	0.148	0.406	1.000	3.01	2100.	1384.	17.04
	2008.	0.936	0.000	0.000	13.65	15.63				
	1.117	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002

86.0	1648.	0.977	289.	0.150	0.430	1.000	2.66	1994.	1288.	16.23
	1739.	0.925	0.000	0.000	13.65	15.40				
	1.092	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
84.0	1383.	0.986	282.	0.150	0.459	1.000	2.34	1892.	1196.	15.44
	1474.	0.925	0.000	0.000	13.65	15.08				
	1.067	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0002
82.0	1118.	1.020	276.	0.147	0.493	1.000	2.04	1795.	1109.	14.68
	1207.	0.944	0.000	0.000	13.65	14.59				
	1.041	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0002
80.0	852.	1.101	269.	0.139	0.533	1.000	1.77	1702.	1026.	13.95
	939.	0.999	0.000	0.000	13.65	13.88				
	1.016	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
78.0	577.	1.311	262.	0.121	0.581	1.000	1.52	1614.	949.	13.24
	660.	1.145	0.000	0.000	13.65	12.76				
	0.990	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0003
76.0	280.	2.122	255.	0.083	0.621	1.000	1.30	1530.	876.	12.56
	354.	1.675	0.000	0.000	13.65	10.73				
	0.965	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0003

MACH = 0.500 ALTITUDE = 5000.00 FEET

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	5370.	0.595	285.	0.232	0.596	1.000	2.03	2697.	1523.	22.49
	5443.	0.587	0.000	0.000	13.65	10.80				
	1.270	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0005
98.0	4865.	0.604	279.	0.229	0.590	1.000	2.18	2606.	1510.	21.51
	4939.	0.595	0.000	0.000	13.65	11.76				
	1.245	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0004
96.0	4246.	0.614	273.	0.226	0.588	1.000	2.28	2481.	1464.	20.56
	4320.	0.604	0.000	0.000	13.65	12.50				
	1.219	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0004
94.0	3601.	0.639	268.	0.218	0.574	1.000	2.44	2361.	1428.	19.64
	3675.	0.626	0.000	0.000	13.65	13.35				
	1.194	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0003

92.0	2904.	0.694	262.	0.202	0.535	1.000	2.68	2245.	1403.	18.75
	2979.	0.677	0.000	0.000	13.65	14.29				
	1.168	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
90.0	2104.	0.834	256.	0.169	0.453	1.000	3.02	2134.	1389.	17.88
	2180.	0.805	0.000	0.000	13.65	15.28				
	1.143	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
88.0	1582.	0.959	250.	0.149	0.407	1.000	2.99	2027.	1331.	17.04
	1658.	0.915	0.000	0.000	13.65	15.61				
	1.118	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
86.0	1359.	0.955	245.	0.151	0.432	1.000	2.65	1925.	1238.	16.23
	1435.	0.905	0.000	0.000	13.65	15.38				
	1.092	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
84.0	1137.	0.966	239.	0.151	0.461	1.000	2.32	1827.	1149.	15.44
	1213.	0.906	0.000	0.000	13.65	15.04				
	1.067	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0002
82.0	918.	1.000	233.	0.147	0.495	1.000	2.03	1733.	1065.	14.68
	992.	0.925	0.000	0.000	13.65	14.55				
	1.041	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0002
80.0	697.	1.084	228.	0.139	0.536	1.000	1.76	1643.	986.	13.95
	769.	0.982	0.000	0.000	13.65	13.83				
	1.016	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
78.0	467.	1.302	222.	0.120	0.584	1.000	1.51	1558.	911.	13.24
	536.	1.134	0.000	0.000	13.65	12.67				
	0.991	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0003
76.0	218.	2.186	216.	0.080	0.621	1.000	1.29	1477.	841.	12.56
	279.	1.705	0.000	0.000	13.65	10.56				
	0.965	0.0010	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0003

MACH = 0.570 ALTITUDE = 5000.00 FEET

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	5230.	0.629	297.	0.252	0.638	1.000	2.03	2697.	1506.	22.49
	5332.	0.617	0.000	0.000	13.65	10.42				
	1.162	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0005

98.0	4833.	0.647	291.	0.246	0.620	1.000	2.30	2643.	1536.	21.51
	4937.	0.633	0.000	0.000	13.65	11.70				
	1.139	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0004
96.0	4207.	0.659	285.	0.242	0.616	1.000	2.41	2517.	1489.	20.56
	4311.	0.643	0.000	0.000	13.65	12.43				
	1.116	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0004
94.0	3561.	0.687	279.	0.233	0.599	1.000	2.57	2395.	1452.	19.64
	3666.	0.667	0.000	0.000	13.65	13.26				
	1.093	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
92.0	2872.	0.747	273.	0.216	0.559	1.000	2.82	2278.	1426.	18.75
	2979.	0.720	0.000	0.000	13.65	14.17				
	1.069	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0003
90.0	2105.	0.887	267.	0.184	0.478	1.000	3.18	2165.	1411.	17.88
	2209.	0.845	0.000	0.000	13.65	15.15				
	1.046	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
88.0	1601.	1.008	261.	0.165	0.434	1.000	3.15	2057.	1352.	17.04
	1707.	0.945	0.000	0.000	13.65	15.48				
	1.023	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
86.0	1366.	1.011	255.	0.166	0.456	1.000	2.79	1953.	1258.	16.23
	1476.	0.936	0.000	0.000	13.65	15.27				
	1.000	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
84.0	1137.	1.029	249.	0.166	0.482	1.000	2.45	1853.	1168.	15.44
	1246.	0.939	0.000	0.000	13.65	14.96				
	0.976	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0002
82.0	912.	1.072	244.	0.162	0.511	1.000	2.14	1758.	1083.	14.68
	1019.	0.959	0.000	0.000	13.65	14.52				
	0.953	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0002
80.0	686.	1.173	238.	0.153	0.543	1.000	1.85	1667.	1002.	13.95
	791.	1.017	0.000	0.000	13.65	13.88				
	0.930	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0003
78.0	454.	1.427	232.	0.133	0.573	1.000	1.59	1580.	926.	13.24
	555.	1.167	0.000	0.000	13.65	12.87				
	0.907	0.0013	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0003
76.0	209.	2.435	226.	0.092	0.563	1.000	1.36	1498.	855.	12.56
	301.	1.689	0.000	0.000	13.65	11.14				
	0.883	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0003

MACH = 0.700 ALTITUDE = 5000.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	5013.	0.698	325.	0.284	0.699	1.000	2.03	2697.	1467.	22.49
	5204.	0.673	0.000	0.000	13.65	9.53				
	1.037	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0006
98.0	4790.	0.727	319.	0.274	0.662	1.000	2.49	2697.	1560.	21.51
	4989.	0.698	0.000	0.000	13.65	11.31				
	1.016	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0005
96.0	4219.	0.750	312.	0.267	0.646	1.000	2.70	2595.	1543.	20.56
	4422.	0.716	0.000	0.000	13.65	12.20				
	0.996	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0004
94.0	3555.	0.786	306.	0.257	0.624	1.000	2.88	2470.	1505.	19.64
	3763.	0.743	0.000	0.000	13.65	13.00				
	0.975	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0004
92.0	2869.	0.854	299.	0.240	0.582	1.000	3.16	2349.	1477.	18.75
	3074.	0.797	0.000	0.000	13.65	13.88				
	0.954	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0003
90.0	2136.	0.999	293.	0.208	0.505	1.000	3.56	2233.	1461.	17.88
	2329.	0.916	0.000	0.000	13.65	14.82				
	0.933	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0002
88.0	1643.	1.123	286.	0.191	0.463	1.000	3.53	2121.	1400.	17.04
	1840.	1.002	0.000	0.000	13.65	15.16				
	0.913	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0002
86.0	1375.	1.149	280.	0.192	0.475	1.000	3.12	2014.	1302.	16.23
	1589.	0.994	0.000	0.000	13.65	15.00				
	0.892	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0002
84.0	1124.	1.190	273.	0.192	0.488	1.000	2.74	1911.	1209.	15.44
	1343.	0.996	0.000	0.000	13.65	14.75				
	0.871	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0003
82.0	881.	1.270	267.	0.187	0.502	1.000	2.39	1813.	1121.	14.68
	1098.	1.019	0.000	0.000	13.65	14.39				
	0.850	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0003

80.0	642.	1.434	260.	0.178	0.507	1.000	2.07	1719.	1038.	13.95
	856.	1.076	0.000	0.000	13.65	13.88				
	0.830	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0003
78.0	402.	1.846	254.	0.157	0.489	1.000	1.79	1630.	959.	13.24
	610.	1.218	0.000	0.000	13.65	13.11				
	0.809	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0003
76.0	157.	3.705	247.	0.116	0.370	1.000	1.53	1545.	886.	12.56
	353.	1.650	0.000	0.000	13.65	11.89				
	0.788	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0004
74.0	-102.	-4.310	241.	0.030	-1.471	1.000	1.30	1464.	817.	11.90
	69.	6.361	0.000	0.000	13.65	9.63				
	0.767	0.0015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0004

MACH = 0.700 ALTITUDE = 10000.00 FEET

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	4386.	0.696	274.	0.279	0.673	1.000	2.30	2697.	1513.	22.49
	4547.	0.671	0.000	0.000	13.65	10.39				
	1.037	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0011	0.0005
98.0	4005.	0.715	268.	0.273	0.656	1.000	2.56	2628.	1526.	21.51
	4170.	0.686	0.000	0.000	13.65	11.45				
	1.017	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0005
96.0	3468.	0.732	263.	0.269	0.648	1.000	2.68	2503.	1479.	20.56
	3636.	0.698	0.000	0.000	13.65	12.16				
	0.996	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0004
94.0	2921.	0.767	258.	0.259	0.627	1.000	2.86	2381.	1442.	19.64
	3092.	0.724	0.000	0.000	13.65	12.97				
	0.975	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0004
92.0	2355.	0.834	252.	0.241	0.584	1.000	3.14	2265.	1416.	18.75
	2525.	0.778	0.000	0.000	13.65	13.85				
	0.954	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0003
90.0	1751.	0.977	247.	0.210	0.507	1.000	3.54	2153.	1402.	17.88
	1912.	0.894	0.000	0.000	13.65	14.80				
	0.934	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0002

88.0	1344.	1.099	241.	0.192	0.464	1.000	3.51	2045.	1343.	17.04
	1508.	0.979	0.000	0.000	13.65	15.14				
	0.913	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0002
86.0	1123.	1.125	236.	0.193	0.475	1.000	3.10	1942.	1250.	16.23
	1301.	0.971	0.000	0.000	13.65	14.98				
	0.892	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0002
84.0	916.	1.168	230.	0.192	0.489	1.000	2.72	1843.	1160.	15.44
	1097.	0.976	0.000	0.000	13.65	14.72				
	0.871	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0003
82.0	717.	1.248	225.	0.188	0.502	1.000	2.37	1748.	1076.	14.68
	896.	0.998	0.000	0.000	13.65	14.36				
	0.851	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0003
80.0	519.	1.417	219.	0.177	0.507	1.000	2.06	1658.	996.	13.95
	696.	1.057	0.000	0.000	13.65	13.83				
	0.830	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0015	0.0003
78.0	321.	1.846	214.	0.156	0.486	1.000	1.77	1571.	920.	13.24
	492.	1.204	0.000	0.000	13.65	13.05				
	0.809	0.0018	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0014	0.0004
76.0	118.	3.934	208.	0.113	0.354	1.000	1.51	1489.	850.	12.56
	279.	1.664	0.000	0.000	13.65	11.78				
	0.788	0.0017	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0013	0.0004
74.0	-98.	-3.585	203.	0.023	-2.361	1.000	1.28	1411.	783.	11.90
	42.	8.302	0.000	0.000	13.65	9.42				
	0.768	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0010	0.0004

```
SEA-LEVEL STATIC THRUST =     9065.  (MAX)
SEA-LEVEL SFC           =     0.364
 CALLING MODULE NUMBER  6
```

WEIGHT STATEMENT - BOMBERS
*** WEIGHTS DATA ***
ACSYNT MODULE NUMBER 6

COMPONENT	POUNDS	KILOGRAMS	PERCENT
AIRFRAME STRUCTURE	12005.	5445.	26.06
WING	4300.	1951.	9.34
FUSELAGE	4419.	2004.	9.59
HORIZONTAL TAIL	523.	237.	1.14
VERTICAL TAIL	436.	198.	0.95
NACELLES	805.	365.	1.75
ALIGHTING GEAR	1522.	690.	3.30
PROPULSION	3577.	1623.	7.76
ENGINES (2)	3169.	1438.	6.88
FUEL SYSTEM	408.	185.	0.89
FIXED EQUIPMENT	5048.	2290.	10.96
HYD. + PNEU.	290.	132.	0.63
ELECTRICAL	677.	307.	1.47
AVIONICS	1566.	710.	3.40
INSTRUMENTATION	166.	75.	0.36
DE-ICE/AIR CONDITION	369.	167.	0.80
AUXILIARY GEAR	161.	73.	0.35
FURNISH. + EQPT.	465.	211.	1.01
FLIGHT CONTROLS	1353.	614.	2.94
FUEL	11438.	5188.	24.83
PAYLOAD	14000.	6350.	30.39
FLIGHT CREW (1)	240.	109.	0.52
ARMAMENT	0.	0.	0.00
AMMUNITION	1000.	454.	2.17
MISSILES	0.	0.	0.00
BOMBS	1848.	838.	4.01
EXTERNAL TANKS	0.	0.	0.00
ADV. WEAPONS 1	0.	0.	0.00
ADV. WEAPONS 2	0.	0.	0.00
CALCULATED WEIGHT	46068.	20896.	100.00
ESTIMATED WEIGHT	46068.	20896.	
PERCENT ERROR	0.00		

CALLING MODULE NUMBER 10

FINAL VALUES OF NAVY MODULE VARIABLES

CATAPULT TAKEOFF CALCULATIONS,

```
  TAKEOFF GROSS WEIGHT = 46068. LBS
     CATAPULT ENDSPEED =161.4 KNOTS
      LIFTOFF ENDSPEED =164.3 KNOTS
   TAKEOFF STALL SPEED =108.2 KNOTS
MINIMUM WIND OVER DECK =-45.3 KNOTS
  TAKEOFF ACCELERATION =0.277 G"S
            TAKEOFF CL =2.856
            TAKEOFF CD =0.285
ENGINE OUT CLIMB SPEED =  -41.0 FT PER MIN
   TAKEOFF FUEL WEIGHT =11438. LBS
           TAKEOFF AOA =11.57 DEGS
```

ARRESTED LANDING CALCULATIONS

```
CARRIER LANDING WEIGHT =35441. LBS
  APPROACH STALL SPEED = 94.9 KNOTS
MINIMUM APPROACH SPEED =113.8 KNOTS
  CABLE ENGAGING SPEED =145.0 KNOTS
MINIMUM WIND OVER DECK =-19.8 KNOTS
            LANDING CL =3.349
            LANDING CD =0.408
  LANDING RESERVE FUEL = 2660. LBS
ENGINE OUT CLIMB SPEED =  814.0 FT PER MIN
           LANDING AOA =11.75 DEGS
```

OTHER CALCULATIONS

```
OPERATING EMPTY WEIGHT =21119. LBS
    FOLDED TAIL HEIGHT = 11.5 FEET
                NERROR = 0
CALLING MODULE NUMBER 11
```

SUMMARY --- ACSYNT OUTPUT --- NASA, AMES RESEARCH CENTER

A-10 OPTIMIZATION STUDY

GENERAL		FUSELAGE				WING	HTAIL	VTAIL
WG	46068.	LENGTH		53.3	AREA	387.5	118.4	54.1
W/S	118.9	DIAMETER		5.3	WETTED AREA	775.4	189.0	102.7
T/W	0.39	VOLUME		809.4	SPAN	50.3	18.8	9.7
N(Z) ULT	11.3	WETTED AREA		702.9	L.E. SWEEP	0.0	0.0	4.0
CREW	1.	FINENESS RATIO		10.1	C/4 SWEEP	-1.8	-0.1	-4.0
PASENGERS	0.				ASPECT RATIO	6.54	2.99	1.74
					TAPER RATIO	0.66	0.99	0.61
ENGINE		WEIGHTS			T/C ROOT	0.16	0.13	0.13
					T/C TIP	0.13	0.13	0.12
NUMBER	2.		W	WG	ROOT CHORD	9.3	6.3	6.9
LENGTH	8.3	STRUCT.	12005.	26.1	TIP CHORD	6.1	6.3	4.2
DIAM.	3.8	PROPUL.	3577.	7.8	M.A. CHORD	7.8	6.3	5.7
WEIGHT	1478.0	FIX. EQ.	5048.	11.0	LOC. OF L.E.	22.7	45.4	44.8
TSLS	9065.	FUEL	11438.	24.8				
SFCSLS	0.36	PAYLOAD	14000.	30.4				

MISSION SUMMARY

PHASE	MACH	ALT	FUEL	TIME	DIST	L/D	THRUST	SFC	Q
TAKEOFF	0.00	0.	345.	7.0	3268.0				
CLIMB	0.53	5000.	99.	0.9	4.9	11.34	11117.9	0.591	340.2
CRUISE	0.50	5000.	2413.	42.5	230.0	11.64	3778.3	0.898	308.2
CRUISE	0.50	100.	495.	7.3	40.0	10.29	4163.5	0.980	369.0
COMBAT	0.60	100.	3794.	30.0	198.4	13.68	11740.9	0.646	531.4
CRUISE	0.50	100.	471.	7.3	40.0	9.04	3965.6	0.982	369.0
CLIMB	0.51	5000.	73.	0.6	3.5	9.62	11178.2	0.585	324.3
CRUISE	0.50	5000.	2341.	42.5	230.0	9.92	3425.4	0.962	308.2
LOITER	0.27	500.	766.	20.0	59.4	11.90	2790.7	0.824	106.1
LANDING					6438.5				

BLOCK TIME = 2.516 HR
BLOCK RANGE = 806.2 NM

COMBAT PHASES

MACH	ALT	PS1G	NZS	CLS	CDS	ALS	NZI	PSI	CLI	CDI	ALI	CBE
0.60	100.	99.	3.8	0.775	0.0567	6.4	6.0	-550.	1.225	0.2264	11.0177918.	

XIII. EXAMPLE FOUR

A. OVERVIEW

This final example will show the lower weight range that ACSYNT is capable of handling. This will be an oblique wing Unmanned Air Vehicle (UAV) for supersonic intercepts (inspired by Ref 10). It is designed for catapult launch and parachute recovery. The engine is a generic turbojet with 9500 lbs of thrust at sea-level with afterburner. The configuration is shown in Fig 7.

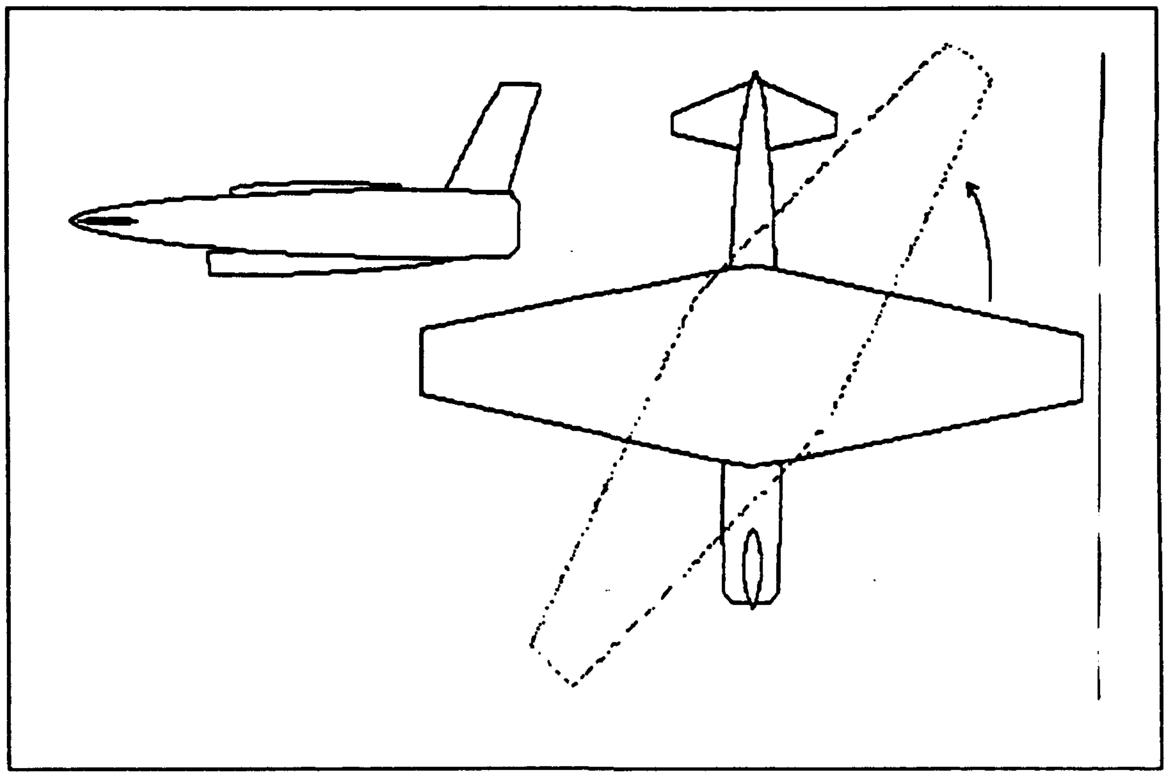

Figure 7. Oblique Wing UAV

B. EXAMPLE FOUR INPUTS

The information required for this design is given below. It is assumed that the user is now familiar with how to navigate through CREATE and many of the steps have been condensed.

- Start CREATE and open a new file with a name of "UAV", select Simple Analysis.
- Enter a project title of "OBLIQUE WING UAV".
- Select item (1) (FIGHTER).
- No change to the selected Modules.
- Maximum weight for convergence: 10000.0
- Geometry Selection Menu: select oblique wing, vertical tail, canards, fuselage pod, fuselage and fuselage fuel (2, 5, 6, 8, 9 and 11).
- Oblique Wing Geometry:
  - Aspect Ratio: 5.50
  - Surface Area: 160.0 (ft^2)
  - Dihedral: 0.0 deg
  - Leading Edge Flap Width: 0.0
  - Wetted Area Multiplier: 0.95
  - Taper Ratio: 0.3
  - T/C Ratio, Wing Root: 0.06
  - T/C Ratio, Wing Tip: 0.06
  - Trailing Edge Flap Width (% chord): 0.0
  - Position of Wing Quarter Chord: 0.55
  - Elevation of Wing on Fuselage: 1.0
  - Fraction of Wing Volume Filled with Fuel: 0.0
  - Fuel Density: 48.62
- Vertical Tail Geometry :
  - Aspect Ratio: 3.0
  - Surface Area: 20.0 (the area of 1 tail)
  - Tail Volume Coefficient: N/A

- LE Sweep: 30.0
- Wetted Area Multiplier: 0.9
- Taper Ratio: 0.50
- T/C Ratio, Root: 0.07
- T/C Ratio, Tip: 0.06
- Number of Vertical Tails: 1.0
- X Location of TE of the Root Chord: 1.0
- Elevation of the Root Chord of the Tail on Fuselage: 1.0
- Sizing Logic: F
- Vertical Tail Sizing Fraction: N/A

• Canard Geometry
  - Aspect Ratio: 2.4
  - Reference Area: 25.0 ft^2
  - Canard Volume Coefficient: N/A
  - Leading Edge Sweep: 30.0 deg
  - Wetted Area Multiplyer: 0.8
  - Taper: 0.4
  - T/C Ratio, Root: 0.06
  - T/C Ratio, Tip: 0.06
  - X Location of Canard LE: 0.05
  - Elevation of Canard on Fuselage: 0.0
  - Canard Location: 1
  - Sizing Logic: F
  - Sizing Fraction: N/A

• 1 Fuselage Pod

• Fuselage Pod Geometry:
  - Engine Pod Diameter: 0.00 (will be sized as engine is sized)
  - Engine Pod Length: 0.00
  - Stand-Off Distance: -2.0
  - Angular Orientation: 0.0
  - X Location of Pod Leading Edge: 0.5
  - Wing Pod Symmetry: 1

• Fuselage Geometry:
  - Maximum Fuselage Diameter: 3.00
  - Fuselage Length: 19.0
  - Diameter of Nose RadarDish: 0.0
  - Afterbody Fineness Ratio: 1.9
  - Fuselage Fineness Ratio: 0.0

- Nose Fineness Ratio: 3.0
- Length of Radar Equipment Behind Radar: 0.0
- Surface Area Complexity Factor: 1.1 (10% more area to account for inlet)
- Fuselage Wall Thickness: N/A
- Mission Fuel Weight Estimate: 2000.0
- Tail Type: 1

• 1 Fuselage Fuel Bay
  - Fuel Density: 48.62 (JP-4)

• Trajectory Page 1:
  - Cruise Mach Number: 0.8
  - Mach Number for Max Endurance: 0.5
  - Design Load Factor: 10.0
  - Ultimate Load Factor: 15.0
  - Aircraft Range: 600.0
  - Maximum Dynamic Pressure: 1500.0
  - Take-Off Obstacle Requirement: N/A

• Trajectory Page 2:
  - Time for Warm-up and Taxi: 5.0
  - Power Setting During Warm-up and Taxi: 5
  - Time for Take-off: 0.5
  - Power Setting for Take-off: 1
  - Breguet Altitude Search Flag: 0
  - Loiter Altitude Search Flag: 0

• Trajectory Page 3:
  - Fuel Reserve: 0.05
  - Total Internal Fuel: 2500.0
  - External Fuel: 0.0
  - Weight of Trapped Fuel: 20.0
  - Engine Sizing Flag: -2
  - Number of Cruise Phases (see below): 2
  - Total number of Trajectory Phases (see below): 6
  - Debug Option: 0

• Trajectory Phases. Use 6.0 g's during combat.

TABLE 10. UAV Mission

Phase	Mach Start	Mach End	Alt Start	Alt End	Horiz Dist	Horiz Time	Power Setting
Climb	0.00	0.00	0	30000	0.0	0.0	2
Cruise	0.8	0.8	30000	-1	240	30.0	4
Accel	0.8	1.6	30000	-1	0	2.0	1
Combat	1.6	1.6	30000	-1	0	4.0	1
Cruise	0.8	0.8	30000	-1	160	20.0	4
Descent	0.00	0.00	30000	0	0.0	0.0	5

- Aerodynamics Page 1:
  - Ratio of Body Base Area to Max Body Area: 0.15
  - Angle of Attack for Cl max: 35.0
  - Maximum Angle of Attack: 40.0
  - Width of the Fuselage at the Nose: 0.
  - Boat Tail Exposure Factor: 0.0
  - Cl max Scaling Factor for clean aircraft: 1.0
  - Laminar-Turbulent Weighting Factor: 0.7

- Aerodynamics Page 2:
  - Ref Mach Number Array: 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0
  - Cl at Zero AOA for Body: 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00, 0.00
  - Canard Cl at Zero AOA: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Wing Cl at Zero AOA: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Zero Lift Pitching Moment: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0
  - Wing Sweep Angles: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0 (wing sweep is programmed for normal Mach number)

- Aerodynamics Page 3:
  - Variable Wing Sweep Flag: T
  - Normal Mach Number Calculation Code: 0
  - Desired Normal Component: 0.7
  - Max Sweep: 60.0
  - Min Sweep: 0.0

- **Aerodynamics page 4:**
  - Wing Airfoil Section Code: 1
  - Wing LE Radius/Chord Ratio: N/A
  - Canard Airfoil Section Code: 1
  - Canard LE Radius/Chord Ratio: N/A
  - Distance Between the Twin Nacelles: N/A
  - Supercritical Wing Flag: 0
  - Body Cross-section Code: 0

- **Aerodynamics Page 5:**
  - Pod Cowl Exposure Factor: 0.0
  - Friction Drag Multiplying Factor: 0.7
  - Canard Incidence: N/A
  - Average Flap Chord: 0.
  - Total Area of Both Wing Flap: 0.0
  - Total Span of Both Flaps: 0.0
  - Desired Location of CG: 0.25
  - Static Margin for CG: 0.10
  - Height of CG Above Fuselage Centerline: 0.0
  - Horizontal Tail Incidence: 0.0

- **Aerodynamics Page 6:**
  - Mach Numbers for Detailed Aero Output: 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.4, 1.6
  - Total Number of Requested Mach Numbers: 8
  - Altitudes for Detailed Aero Output: 10000.0, 30000.0, 30000.0, 30000.0, 30000.0, 30000.0, 30000.0, 30000.0
  - Lift Coefficients for Detailed Output: 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0

- **Aerodynamics Page 7:**
  - Drag due to External Bombs: 0.0
  - Drag due to External Stores: 0.0
  - Drag due to Drop Tanks: 0.0
  - Drag due to Additional Items: 0.0

- **Aerodynamics Page 8:**
  - C_L max for Landing: -1.0
  - C_L max for Take-off: -1.0
  - TE Flap Angle for Landing: 0.0
  - TE Flap Angle for Take-off: 0.0
  - LE Slat Angle for Landing: 0.0
  - LE Slat Angle for Take-off: 0.0

- L/D Ratio for Landing: -1.0
- L/D Ratio for Take-off: -1.0
- Enter "0" to Continue

- Engine Type: Change to Type 1 (J-85)

- Propulsion Page 1:
  - Engine Diameter: 0.0
  - Engine Length: 0.0
  - Engine Weight: 0.0
  - Inner Turbine Flow Area: 0.385
  - Bypass Ratio: 0.0
  - Engine Face Diameter: 1.365
  - Nozzle Fineness Ratio: 0.0
  - Cowl Fineness Ratio: 0.0
  - Enter "0" to Continue

- Propulsion Page 2:
  - Engine Hub/Tip Ratio: 0.6
  - Fuel Heat Value: 18600.0
  - Scaling Factor for Inlet Capture Area: 1.0
  - Engine Percent Corrected Airflow: 100.0
  - Maximum Nacelle Diameter Factor: 1.15
  - Total Nacelle Length Factor: 1.5
  - Engine Face Mach Number: 0.7
  - Distance Between Nozzles/Nozzle Diameter: 1.0
  - Nozzle Velocity Coefficient: 0.98

- Propulsion Page 3:
  - Cooling/Primary Airflow Ratio: 0.0
  - Year of Installation: 95.0
  - Thrust w/Afterburner: 9500.0
  - Thrust w/o Afterburner: N/A
  - Thrust/Weight Ratio at Take-off: N/A
  - Afterburner Adiabatic Efficiency: 0.9
  - Combustor Adiabatic Efficiency: 0.93
  - Ductburner Adiabatic Efficiency: N/A
  - Compressor Adiabatic Efficiency: 0.9

- Propulsion Page 4:
  - Fan Adiabatic Efficiency: N/A
  - Turbine Adiabatic Efficiency: 0.92
  - Design Fan Pressure Ratio: N/A

- Outer Compressor Pressure Ratio: 2.0
- Overall Compressor Pressure Ratio: 19.0
- Combustor Pressure Ratio: 0.95
- Afterburner Pressure Ratio: 0.95
- Afterburner Pressure Ratio, Not Lit: 0.95
- Ductburner Pressure Ratio: N/A
- Ductburner Pressure Ratio, Not Lit: N/A

- Propulsion Page 5:
  - Average Compressor Stage Rise: 1.27
  - Turbine Inlet Temp: 2600.0
  - Afterburner Max Temp: 3000.0
  - Ductburner Max Temp: 0.0
  - Incremental Inlet Total Press Recovery Reduction: 0.0
  - Number of Engines: 1
  - Inlet Pressure Recovery Code: 1

- Propulsion Page 6:
  - SFC Multiplying Factor for Condition One: 1.0
  - Upper Limit on Mach Number for Condition One: 1.0
  - SFC Multiplying Factor for Condition Two: 1.0
  - Lower Limit on Mach Number for Condition Two: 1.1
  - SFC Multiplying Factor for Burner Lit: 1.0
  - Scale Factor for Nozzle Boat-Tail drag: 0.0
  - Scale Factor for Total Installation Drag: 1.0
  - Scale Factor for Nozzle Interference Drag: 0.0

- Propulsion Page 7:
  - Altitudes for Detailed Output: 0.0, 1000.0, 30000.0, 30000.0, 30000.0, 30000.0
  - Mach Numbers for Detailed Output: 0.0, 0.6, 0.8, 1.0, 1.2, 1.6
  - Number of Altitude/Mach Number Combinations without the Afterburner lit: 3
  - Engine Type Indicator: 0
  - Afterburner Indicator: 2
  - Ductburner Indicator: 0
  - Nozzle Type Indicator: 1

- Weights Page 1:
  - Wing Slope: 0.8 (all composite construction)
  - Fuselage Slope: 0.8
  - Horizontal Tail: 0.0
  - Vertical Tail: 0.8

- Nacelles: 0.0
- Landing Gear: 0.5 (parachute)
- Engines: 1.0
- Fuel System: 1.0
- Hydraulics: 1.0

- Weights Page 2:
  - Electrical System: 1.0
  - Avionics: 1.0
  - Instrumentation: 1.0
  - Environmental System: 0.0
  - Passenger Accommodations: 0.0
  - APU: 0.0
  - Flight Controls: 1.0
  - Crew Accommodations: 0.0
  - Payload: 400.0

- Weights Page 3:
  - Wing Pivot Factor: 1.0
  - External Tank Factor: 0.0
  - Maximum Mach Number: N/A
  - Oblique Wing Material Density: .056 (graphite/epoxy)
  - Oblique Wing Allowable Stress: 30000.0
  - Wing Weight Equation: N/A
  - Oblique Wing Weight Equation: 1
  - Tail Indicator: 0
  - Body Equation: 1
  - Wing Weight Technique: N/A
  - Estimate of Take-off Gross Weight: 5000.0

- Weights Page 4:
  - Weight of Ammunition: 0.0
  - Weight of Bombs: 0.0
  - Weight of Missiles: 0.0
  - Weight of External Tanks: 0.0

```
CCCCCCC    OOOOOOO    PPPPPPP    EEEEEEE    SSSSSSS
C          O     O    P     P    E          S
C          O     O    P     P    E          S
C          O     O    PPPPPPP    EEEE       SSSSSSS
C          O     O    P          E                S
C          O     O    P          E                S
CCCCCCC    OOOOOOO    P          EEEEEEE    SSSSSSS
```

C O N T R O L   P R O G R A M

F O R

E N G I N E E R I N G   S Y N T H E S I S

T I T L E

OBLIQUE WING UAV

TITLE:
OBLIQUE WING UAV

CONTROL PARAMETERS;

CALCULATION CONTROL,	NCALC =	1
NUMBER OF GLOBAL DESIGN VARIABLES,	NDV =	0
NUMBER OF SENSITIVITY VARIABLES,	NSV =	0
NUMBER OF FUNCTIONS IN TWO-SPACE,	N2VAR =	0
NUMBER OF APPROXIMATING VAR.	NXAPRX =	0
INPUT INFORMATION PRINT CODE,	IPNPUT =	1
DEBUG PRINT CODE,	IPDBG =	0

CALCULATION CONTROL, NCALC

VALUE	MEANING
1	SINGLE ANALYSIS
2	OPTIMIZATION
3	SENSITIVITY
4	TWO-VARIABLE FUNCTION SPACE
5	OPTIMUM SENSITIVITY
6	APPROXIMATE OPTIMIZATION

* * ESTIMATED DATA STORAGE REQUIREMENTS

REAL			INTEGER		
INPUT	EXECUTION	AVAILABLE	INPUT	EXECUTION	AVAILABLE
9	9	5000	1	1	1000

```
AAAAAAA   CCCCCCC   SSSSSSS   Y     Y   N     N   TTTTTTT
A     A   C         S          Y   Y    NN    N      T
A     A   C         S           Y Y     N N   N      T
AAAAAAA   C         SSSSSSS      Y      N  N  N      T
A     A   C               S      Y      N   N N      T
A     A   C               S      Y      N    NN      T
A     A   CCCCCCC   SSSSSSS      Y      N     N      T
```

N A S A - A M E S   P R O G R A M

F O R

A I R C R A F T   S Y N T H E S I S

NAVAL POSTGRADUATE SCHOOL VERSION

T I T L E

OBLIQUE WING UAV

AIRCRAFT TYPE - FIGHTER

```
TITLE:
OBLIQUE WING UAV


AIRCRAFT TYPE - FIGHTER


CONTROL PARAMETERS:
READ CONTROL,                            MREAD =    5
EXECUTION CONTROL,                       MEXEC =    3
WRITE CONTROL,                          MWRITE =    5
NUMBER IDENTIFYING CONVERGENCE
  VARIABLE FOR CONVERGED VEHICLE,        IOBJ =  570
NUMBER IDENTIFYING COMPARISON
  VARIABLE FOR CONVERGED VEHICLE,        JOBJ =  585
SUMMARY OUTPUT PRINT CODE,              IPSUM =    1
GLOBAL ERROR PRINT CODE,               KGLOBP =    0
GLOBAL COMMON INITIALIZATION CODE,       INIT =    0
DEBUG PRINT CODE,                       IPDBG =    2
GLOBAL PLOT CONTROL,                    IGPLT =    1
DATA TRANSFER INFORMATION FILE, IRDDTR    =    7
DATA TRANSFER INFORMATION PRINT, IPDTR    =    0


VEHICLE CONVERGENCE INFORMATION:
CONVERGENCE TOLERANCE, TOL = 0.10000E-03
ESTIM WCALC VS WEXT SLOPE  = 0.75000E+00
BOUNDING WEIGHT, WGMAX     = 0.10000E+05


MODULE IDENTIFICATION NUMBERS:

 NUMBER        MODULE
    1         GEOMETRY
    2         TRAJECTORY
    3         AERODYNAMICS
    4         PROPULSION
    5         STABILITY AND CONTROL
    6         WEIGHTS
    8         GLOBAL I/O
   10         NAVY
   11         SUMMARY OUTPUT
   14         TAKEOFF AND LANDING

MODULES ARE CALLED FOR INPUT IN THE FOLLOWING ORDER:
    1    2    3    4    6

MODULES ARE CALLED FOR EXECUTION IN THE FOLLOWING ORDER:
    1    2    6

MODULES ARE CALLED FOR OUTPUT IN THE FOLLOWING ORDER:
    1    2    3    4    6
CALLING MODULE NUMBER  1
```

```
GEOMETRY DATA CARDS
 1*** GEOMETRY DATA ***
 2 $QWING
 3      AR= 5.50,        AREA= 160.00,   DIHED= 0.00,
 4      LFLAPC=0.00,     SWFACT=0.95,    TAPER=0.30,
 5      TCROOT=0.06,     TCTIP=0.06,     TFLAPC=0.00,
 6      XWING=0.55,      ZROOT= 1.00,    WFFRAC=0.00,
 7      FDENWG= 48.62,   OUTCOD=2,
 8      $END
 9 $VTAIL
 10      AR= 3.00,        AREA=  20.00,   CVVT=0.08,
 11      SWEEP=30.00,     SWFACT=0.90,    TAPER=0.50,
 12      TCROOT=0.07,     TCTIP=0.06,     VTFRAC=0.000,
 13      VTNO=1.0,        XVTAIL=1.00,    YROOT=0.00,
 14      ZROOT=1.00,      KSWEEP=0,       OUTCOD=2,
 15      SIZIT=F,
 16      $END
 17 $CANARD
 18      AR= 2.40,        AREA=  25.00,   CVCAN=-0.80,
 19      SWEEP=30.00,     SWFACT=0.80,    TAPER=0.40,
 20      TCROOT=0.06,     TCTIP=0.06,     XCAN=0.05,
 21      ZROOT= 0.00,                     NCAN=1,
 22      KSWEEP=0,        OUTCOD=2,       SIZIT=F,
 23      CFRAC=0.000,     $END
 24 $FPOD
 25      DIAM=  0.00,     LENGTH=   0.00, SOD=-2.00,
 26      THETA= 0.00,     X=0.5,          OUTCOD=2,
 27      SYMCOD=1,
 28      $END
 29 $FUS
 30      BDMAX= 3.00,     BODL= 19.00,    DRADAR= 0.00,
 31      FRAB= 1.90,      FRATIO= 0.00,   FRN= 3.00,
 32      LRADAR= 0.00,    SFFACT= 1.10,   WALL= 0.00,
 33      WFUEL=  2000.0,OUTCOD=2,         ITAIL=0,
 34      $END
 35 $FUEL
 36      DEN=48.62,       FRAC=1.00,      WFUEL=      0.0,
 37      OUTCOD=2,
 38      $END

END OF GEOMETRY DATA CARDS
  38 CARDS READ
```

NASA/AMES A C S Y N T **INITIAL OUTPUT**

FUSELAGE DEFINITION

X	R	AREA
0.00	0.00	0.00
0.38	0.23	0.17
0.76	0.38	0.46
1.14	0.51	0.82
1.52	0.62	1.22
1.90	0.72	1.64
2.28	0.81	2.08
2.66	0.90	2.53
3.04	0.97	2.97
3.42	1.04	3.41
3.80	1.11	3.84
4.18	1.16	4.26
4.56	1.22	4.65
4.94	1.26	5.02
5.32	1.31	5.37
5.70	1.35	5.69
6.08	1.38	5.98
6.46	1.41	6.24
6.84	1.43	6.47
7.22	1.46	6.66
7.60	1.47	6.81
7.98	1.49	6.93
8.36	1.49	7.02
8.74	1.50	7.06
9.12	1.50	7.07
9.50	1.50	7.07
9.88	1.50	7.07
10.26	1.50	7.07
10.64	1.50	7.07
11.02	1.50	7.07
11.40	1.50	7.07
11.78	1.50	7.07
12.16	1.50	7.07
12.54	1.50	7.07
12.92	1.50	7.07
13.30	1.50	7.07
13.68	1.49	7.02
14.06	1.48	6.88
14.44	1.45	6.65
14.82	1.42	6.33
15.20	1.37	5.92
15.58	1.32	5.44
15.96	1.25	4.89
16.34	1.17	4.28
16.72	1.07	3.62
17.10	0.97	2.93
17.48	0.84	2.22
17.86	0.70	1.53
18.24	0.53	0.88
18.62	0.32	0.33
19.00	0.00	0.00

FUSELAGE

MAX. DIAMETER......	3.000
FINENESS RATIO.....	6.333
SURFACE AREA.......	155.787
VOLUME............	91.598

NASA/AMES A C S Y N T **INITIAL OUTPUT**

DIMENSIONS OF PLANAR SURFACES

	WING	H.TAIL	V.TAIL	CANARD	UNITS
PLAN AREA..........	160.0	0.0	20.0	25.0	(SQ.FT.)
SURFACE AREA.......	304.5	0.0	36.1	20.5	(SQ.FT.)
VOLUME.............	39.7	0.0	2.5	3.6	(CU.FT.)
SPAN...............	29.665	0.000	7.746	7.746	(FT.)
L.E. SWEEP.........	5.592	0.000	30.000	30.000	(DEG.)
C/4 SWEEP..........	0.000	0.000	27.555	21.741	(DEG.)
T.E. SWEEP.........	-16.368	0.000	19.551	-7.797	(DEG.)
ASPECT RATIO	5.500	0.000	3.000	2.400	
ROOT CHORD.........	8.298	0.000	3.443	4.611	(FT.)
ROOT THICKNESS.....	5.974	0.000	2.892	3.320	(IN.)
ROOT T/C	0.060	0.000	0.070	0.060	
TIP CHORD..........	2.489	0.000	1.721	1.844	(FT.)
TIP THICKNESS......	1.792	0.000	1.239	1.328	(IN.)
TIP T/C	0.060	0.000	0.060	0.060	
TAPER RATIO	0.300	0.000	0.500	0.400	
MEAN AERO CHORD....	5.915	0.000	2.678	3.425	(FT.)
LE ROOT AT.........	8.376	0.000	15.557	0.950	(FT.)
C/4 ROOT AT........	10.450	0.000	16.418	2.103	(FT.)
TE ROOT AT.........	16.673	0.000	19.000	5.561	(FT.)
LE M.A.C. AT.......	8.971	0.000	17.545	1.908	(FT.)
C/4 M.A.C. AT......	10.450	0.000	18.214	2.765	(FT.)
TE M.A.C. AT.......	14.886	0.000	20.223	5.333	(FT.)
Y M.A.C. AT........	6.085	0.000	3.443	1.660	
LE TIP AT..........	9.828	0.000	20.029	3.186	(FT.)
C/4 TIP AT.........	10.450	0.000	20.460	3.647	(FT.)
TE TIP AT..........	12.317	0.000	21.751	5.030	(FT.)
ELEVATION..........	1.500	0.000	1.500	0.000	(FT.)
VOLUME COEFF.		0.000	0.033	-0.203	

E X T E N S I O N S

	Strake	Rear Extension
Centroid location at.......	0.000	0.000
Area.......................	0.000	0.000
Wetted Area................	0.000	0.000
Volume.....................	0.000	0.000
Sweep Angle................	0.000	

F U E L T A N K S

TANK	VOLUME	WEIGHT	DENSITY
WING	0.	0.	48.62
FUS#1	0.	0.	48.62
FUS#2	0.	0.	50.00
TOTAL		0.	

MISSION FUEL REQUIRED= 0.

AVAILABLE FUEL VOLUME IN WING= 32.

AIRCRAFT WEIGHT = 0.000 Lbs.
AIRCRAFT VOLUME = 137.419 Cu.Ft.
AIRCRAFT DENSITY = 0.000 Lbs./Cu.Ft.
CASE= 4
CALLING MODULE NUMBER 2

TRAJECTORY INPUT

```
TIMTO1 = 5.0        MENDUR =     0.     NCRUSE = 2     IPLOT = 0
TIMTO2 = 0.5          QMAX =  1500.     IPSIZE =-2     HMINP =      0.
FRFURE = 0.05        XDESC =   80.0     IPSTO1 = 5     HMAXP = 40000.
DESLF =,10.00       WKFUEL = 1.000      IPSTO2 = 1     DELHP =  4000.
 ULTLF =15.00       CRMACH = 0.800       IBREG = 0    SMMINP = 0.300
 RANGE =    600.    WKLAND = 0.570      IENDUR = 0    SMMAXP = 0.900
 WFUEL =   2500.     FLFAC = 0.600      IPRINT = 0     DELMP = 0.100
 WFEXT =      0.     DECEL = 0.250      KERROR = 2    WCOMBP =       0.50
WFTRAP =     20.    NLEGCL = 0          NLEGCR = 0    NLEGLO = 0
FWGMAX = 1.200         TOL = 0.001      MILCOM = 0     NMISS = 1
                                                       NCODE = 0
 MMPROP = 1
```

MISSION 1

PHASE	MACH NO. START	MACH NO. END	ALTITUDE START	ALTITUDE END	HORIZONTAL DIST	HORIZONTAL TIME	NO. TURN	VIND "G"S	WKFUEL	M	IP	IX	W	B	A	P
CLIMB	0.00	0.00	0	30000	0.0	0.0	0.0	0.0	1.0000	1	2	0	0	0	0	0
CRUISE	0.80	0.80	30000	-1	240.0	30.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
ACCEL	0.80	1.60	30000	-1	0.0	2.0	0.0	0.0	1.0000	1	1	0	0	0	0	0
COMBAT	1.60	1.60	30000	-1	0.0	4.0	0.0	6.0	1.0000	1	1	0	0	0	0	0
CRUISE	0.80	0.80	30000	-1	160.0	20.0	0.0	0.0	1.0000	1	4	0	0	0	0	0
DESCENT	0.00	0.00	30000	0	0.0	0.0	0.0	0.0	1.0000	1	5	0	0	0	0	0

```
CALLING MODULE NUMBER  3
CALLING MODULE NUMBER  4
```

```
                    PROPULSION INPUT
                     VERSION 04-76

*** PROPULSION DATA ***


AENDIA =     0.000 AENLE   =     0.000 AENWT   =     0.000
ALTI   =     0.000 AM      =     0.000 ATURB   =     0.385
AENTW  =     0.000
AUAENG =     0.000 AWAENG  =     0.157 BA      =     0.000
DELPR  =     0.000 DELT57  =   100.000 DEPWCC  =     2.000
DIA1   =     1.365 EAB1    =     0.900 EB1     =     0.930
ED1    =     0.750 ETAC1   =     0.900 ETAF1   =     0.900
ETAT1  =     0.920 HTR     =     0.600 HVF     = 18600.000
MACH1  =     1.000 MACH2   =     1.100 PCDFAC  =     1.000
POSA   =    29.920 PRFD    =     1.000 PWCC    =   100.000
P11P1  =     2.000 P2P1    =    21.000 R10A    =    -1.000
R32    =     0.950 R54     =     0.950 R54N    =     0.950
R711   =     0.980 R711N   =     0.820 SCPR    =     1.270
SFADP  =     1.000 SFADSP  =     1.000 SFAUXP  =     1.000
SFBEP  =     1.000 SFBPP   =     1.000 SFBTP   =     0.000
SFDIVP =     1.000 SFINSP  =     1.000 SFIP    =     0.000
SFSFC1 =     1.000 SFSFC2  =     1.000 SFSFC3  =     1.000
SM1    =     0.700 SODG    =     1.000 TOSA    =   518.000
TR     =   520.000 TWAB    =     9500. TWOAB   =     2720.
TWTO   =     0.500 T3      =     2600. T5M     =     3400.
T51    =     3000. T7M     =     3400. T71     =        0.
VC1    =     0.980 WCWA1   =     0.000 XMDES   =     0.850
XMT    =     0.850 YREN    =       95. FRBT    =     0.000
FRPN   =     0.000 RDIAM   =     1.150 RLENG   =     1.500


IPR    =         1 IPRINT  =         0 IPLOT   =         0
KERROR =         0 KODE    =         0 KT5     =         2
KT7    =         0 MINPR   =         1 NAB     =         3
NOZZ   =         1 NPROP   =         6 NSUMM   =        15
                                       IENG    =         1 (J85 )


THESE VARIABLES ARE USED BY TABLE LOOK UP
ESF    =     1.000 NDTAIL   = 0  IPDBUG  = 0  IIPRINT = 0


ALTD   =       0.      10000.      30000.      30000.      30000.      30000.
XMACH  =     0.000      0.600       0.800       1.000       1.200       1.600
XMPRI  =     0.000      0.300       0.600       0.900       1.200       4.000
XPRI   =     1.000      1.000       1.000       1.000       1.000       1.000
XMPRI1 =      0.000      0.000       0.000       0.000       0.000       0.000       0.000
              0.000      0.000       0.000
XPRI1  =     0.000      0.000       0.000       0.000       0.000       0.000       0.000
             0.000      0.000       0.000
XMPRI2 =      0.000      0.000       0.000       0.000       0.000       0.000       0.000
              0.000      0.000       0.000
XPRI2  =     0.000      0.000       0.000       0.000       0.000       0.000       0.000
             0.000      0.000       0.000
   CALLING MODULE NUMBER  6
```

```
                              INITIAL WEIGHTS INPUT DATA
                              ACSYNT MODULE NUMBER 6
AIRCRAFT TYPE:  FIGHTER
TITLE:  *** WEIGHTS DATA ***

CONTROL OPTIONS

    IPRINT =  1    IGRAPH =  1    ITAIL  =  0    KERROR =  0
    IDELT  =  0    IOBLIQ =  1    KWING  =  1    KBODY  =  1
    K1     = 1.00 K2      = 1.00 K3     =  1.0 K4     =  1.0
    K5     = 1.00 K6      = 1.00 AFMACH = 0.85 MAXIT  =  1
    KB     = 0.00 KP1     = 1.00 KP2    = 0.00
    FR     = 1.50 TECHG   = 1.00 WGTO   =      5000.
    STRESS =    30000.           DENS   =  0.056     FLIFTF =0.000
    TECHI  =  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00  1.00
  SLOPE(1) =  0.80  0.80  0.80  0.80  0.80  0.50  1.00  1.00
  SLOPE(9) =  1.00  1.00  1.00  1.00  0.00  0.00  0.00  1.20  0.00

INITIAL ESTIMATES
 IF CODE = 1, WEIGHT IS FIXED

 QUANTITY       VALUE   CODE           QUANTITY      VALUE   CODE

  WAF     =      1500.   0              WAIRC   =      50.   0
  WAPU    =        0.    0              WAMMUN  =       0.   0
  WARM    =        0.    0              WBAG    =       0.   0
  WBB1    =        0.    0              WBODY   =     800.   0
  WCAND   =        0.    0              WCARGO  =       0.   0
  WCREW   =      100.    0              WE      =     550.   0
  WELT    =      200.    0              WEP     =     125.   0
  WETANK  =        0.    0              WFEQ    =     690.   0
  WFS     =      140.    0              WCA     =     140.   0
  WGEAR   =       15.    0              WHDP    =      60.   0
  WHT     =       55.    0              WINST   =      55.   0
  WLG     =      200.    0              WMISS   =       0.   0
  WNA     =       50.    0              WPA     =       0.   0
  WPASS   =        0.    0              WPL     =     400.   1
  WPS     =      690.    0              WSC     =     150.   0
  WTSUM   =     5000.    0              WVT     =      50.   0
  WWING   =      400.    0              WBOMB   =       0.   0
  WENVP   =        0.    0              WPIV    =       0.   0
  WLIFTF  =        0.    0              WBB2    =       0.   0


    * * * BEGIN VEHICLE CONVERGENCE

    ESTIMATED GROSS WEIGHT  = 0.50000E+04
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2

    HN = 0.0000000E+00       A = 0.1116450E+04     SMN = 0.2613667E+00
   RHO = 0.2376891E-02       Q = 0.1011949E+03
DXCRUS = 0.0000000E+00       W = 0.3301159E+04

    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49873E+04

    SLOPE OF WCALC VS WEST LINE = 0.75000E+00
```

```
    ESTIMATED GROSS WEIGHT  = 0.49494E+04
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2

    HN = 0.0000000E+00       A = 0.1116450E+04     SMN = 0.2594699E+00     RHO =
0.2376891E-02       Q = 0.9973146E+02
DXCRUS = 0.0000000E+00       W = 0.3258455E+04

    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49751E+04

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.49833E+04
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2

    HN = 0.0000000E+00       A = 0.1116450E+04     SMN = 0.2605657E+00     RHO =
0.2376891E-02       Q = 0.1005756E+03
DXCRUS = 0.0000000E+00       W = 0.3286344E+04

    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49896E+04

    SLOPE OF WCALC VS WEST LINE = 0.30000E+00

    ESTIMATED GROSS WEIGHT  = 0.49895E+04
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2

    HN = 0.0000000E+00       A = 0.1116450E+04     SMN = 0.2607631E+00     RHO =
0.2376891E-02       Q = 0.1007281E+03
DXCRUS = 0.0000000E+00       W = 0.3291383E+04

    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49923E+04

    SLOPE OF WCALC VS WEST LINE = 0.43083E+00

    ESTIMATED GROSS WEIGHT  = 0.49944E+04
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2

    HN = 0.0000000E+00       A = 0.1116450E+04     SMN = 0.2609215E+00     RHO =
0.2376891E-02       Q = 0.1008505E+03
DXCRUS = 0.0000000E+00       W = 0.3295425E+04

    CALLING MODULE NUMBER  6

    CALCULATED GROSS WEIGHT = 0.49943E+04


    * * * END VEHICLE CONVERGENCE


     4 CONVERGENCE ITERATIONS REQUIRED
    CALLING MODULE NUMBER  1
    CALLING MODULE NUMBER  2
SUMMARY OF NON FATAL ERRORS ENCOUNTERED IN PROP
P5 IS LESS THAN P6S     1  TIMES
SUMMARY OF NON FATAL ERRORS ENCOUNTERED IN PROP
```

```
P5 IS LESS THAN P6S     1  TIMES
SUMMARY OF NON FATAL ERRORS ENCOUNTERED IN PROP
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P5 IS LESS THAN P6S     1  TIMES
SUMMARY OF NON FATAL ERRORS ENCOUNTERED IN PROP
P5 IS LESS THAN P6S     1  TIMES

     HN = 0.0000000E+00        A = 0.1116450E+04     SMN = 0.2609196E+00     RHO =
0.2376891E-02       Q = 0.1008490E+03
DXCRUS = 0.0000000E+00        W = 0.3295376E+04

     CALLING MODULE NUMBER  6
     CALLING MODULE NUMBER  1
```

NASA/AMES A C S Y N T **FINAL OUTPUT**

FUSELAGE DEFINITION

X	R	AREA
0.00	0.00	0.00
0.38	0.23	0.17
0.76	0.38	0.46
1.14	0.51	0.82
1.52	0.62	1.22
1.90	0.72	1.64
2.28	0.81	2.08
2.66	0.90	2.53
3.04	0.97	2.97
3.42	1.04	3.41
3.80	1.11	3.84
4.18	1.16	4.26
4.56	1.22	4.65
4.94	1.26	5.02
5.32	1.31	5.37
5.70	1.35	5.69
6.08	1.38	5.98
6.46	1.41	6.24
6.84	1.43	6.47
7.22	1.46	6.66
7.60	1.47	6.81
7.98	1.49	6.93
8.36	1.49	7.02
8.74	1.50	7.06
9.12	1.50	7.07
9.50	1.50	7.07
9.88	1.50	7.07
10.26	1.50	7.07
10.64	1.50	7.07
11.02	1.50	7.07
11.40	1.50	7.07
11.78	1.50	7.07
12.16	1.50	7.07
12.54	1.50	7.07
12.92	1.50	7.07
13.30	1.50	7.07
13.68	1.53	7.37
14.06	1.55	7.57
14.44	1.56	7.68
14.82	1.56	7.69
15.20	1.55	7.59
15.58	1.53	7.39
15.96	1.50	7.08
16.34	1.46	6.67
16.72	1.40	6.15
17.10	1.33	5.54
17.48	1.24	4.82
17.86	1.13	4.02
18.24	1.00	3.14
18.62	0.83	2.16
19.00	0.54	0.93

NACELLE DEFINITION

X-XNOSE	R	AREA
0.00	1.04	3.41
1.98	1.04	3.41
5.93	1.04	3.41
7.91	1.04	3.41

NACELLE LOCATION

X	Y	Z
9.50	0.46	0.00

	FUSELAGE		**PODS**
MAX. DIAMETER......	3.000	.....	2.082
FINENESS RATIO.....	6.333		
SURFACE AREA.......	166.616	.....	51.755 (EACH)
VOLUME.............	101.658		

NASA/AMES A C S Y N T **FINAL OUTPUT**

DIMENSIONS OF PLANAR SURFACES

	WING	H.TAIL	V.TAIL	CANARD	UNITS
PLAN AREA..........	160.0	0.0	20.0	25.0	(SQ.FT.)
SURFACE AREA.......	304.5	0.0	36.1	20.5	(SQ.FT.)
VOLUME.............	39.7	0.0	2.5	3.6	(CU.FT.)
SPAN...............	29.665	0.000	7.746	7.746	(FT.)
L.E. SWEEP.........	5.592	0.000	30.000	30.000	(DEG.)
C/4 SWEEP..........	0.000	0.000	27.555	21.741	(DEG.)
T.E. SWEEP.........	-16.368	0.000	19.551	-7.797	(DEG.)
ASPECT RATIO	5.500	0.000	3.000	2.400	
ROOT CHORD.........	8.298	0.000	3.443	4.611	(FT.)
ROOT THICKNESS.....	5.974	0.000	2.892	3.320	(IN.)
ROOT T/C	0.060	0.000	0.070	0.060	
TIP CHORD..........	2.489	0.000	1.721	1.844	(FT.)
TIP THICKNESS......	1.792	0.000	1.239	1.328	(IN.)
TIP T/C	0.060	0.000	0.060	0.060	
TAPER RATIO	0.300	0.000	0.500	0.400	
MEAN AERO CHORD....	5.915	0.000	2.678	3.425	(FT.)
LE ROOT AT.........	8.376	0.000	15.557	0.950	(FT.)
C/4 ROOT AT........	10.450	0.000	16.418	2.103	(FT.)
TE ROOT AT.........	16.673	0.000	19.000	5.561	(FT.)
LE M.A.C. AT.......	8.971	0.000	17.545	1.908	(FT.)
C/4 M.A.C. AT......	10.450	0.000	18.214	2.765	(FT.)
TE M.A.C. AT.......	14.886	0.000	20.223	5.333	(FT.)
Y M.A.C. AT........	6.085	0.000	3.443	1.660	
LE TIP AT..........	9.828	0.000	20.029	3.186	(FT.)
C/4 TIP AT.........	10.450	0.000	20.460	3.647	(FT.)
TE TIP AT..........	12.317	0.000	21.751	5.030	(FT.)
ELEVATION..........	1.500	0.000	1.500	0.000	(FT.)
VOLUME COEFF.		0.000	0.033	-0.203	

E X T E N S I O N S

	Strake	Rear Extension
Centroid location at.......	0.000	0.000
Area.......................	0.000	0.000
Wetted Area................	0.000	0.000
Volume.....................	0.000	0.000
Sweep Angle................	0.000	

F U E L T A N K S

TANK	VOLUME	WEIGHT	DENSITY
WING	0.	0.	48.62
FUS#1	37.	1804.	48.62
FUS#2	0.	0.	50.00
TOTAL		1804.	

MISSION FUEL REQUIRED= 1804.

AVAILABLE FUEL VOLUME IN WING= 32.

AIRCRAFT WEIGHT = 4994.351 Lbs.
AIRCRAFT VOLUME = 147.479 Cu.Ft.
AIRCRAFT DENSITY = 33.865 Lbs./Cu.Ft.
CASE= 4
CALLING MODULE NUMBER 2

TRAJECTORY OUTPUT

MISSION 1 (PAYLOAD = 400. LB)

PHASE	M SFC(I) SFC(U)	H THRUST(I) THRUST(U)	CL CD CDINST	ALPHA GAMMA L/D	WFUEL W THR/THA	TIME WA PR	VEL Q X
CLIMB	0.94	30000.	0.0627	0.89	49.4	0.62	936.
	1.00	3283.	0.0067	36.81	4772.4	43.78	390.
CYCLE	0.99	0.	0.0007	9.29	1.00	1.00	3.
CRUISE	0.80	30000.	0.1030	1.25	181.9	30.54	796.
	1.02	348.	0.0077	0.00	4590.5	28.41	282.
CYCLE	1.02	348.	0.0000	13.35	0.11	1.00	240.
ACCEL	1.60	30000.	0.0248	0.77	130.8	0.73	1592.
	1.74	8601.	0.0345	0.00	4459.6	81.96	1128.
CYCLE	1.71	8733.	0.0007	0.72	1.86	0.95	9.
COMBAT	1.60	30000.	0.1450	4.19	891.9	4.00	1592.
	1.66	8061.	0.0445	0.00	3567.8	81.96	1128.
CYCLE	1.63	8733.	0.0007	3.26	1.74	0.95	63.
CRUISE	0.80	30000.	0.0773	0.93	115.6	20.36	796.
	1.06	321.	0.0071	0.00	3452.2	28.31	282.
CYCLE	1.06	321.	0.0000	10.91	0.10	1.00	160.
DESCENT	0.26	0.	0.2480	3.08	156.8	23.98	291.
	1.29	435.	0.0143	3.30	3295.4	50.04	101.
CYCLE	1.29	435.	0.0000	17.37	0.06	1.00	85.

FUEL SUMMARIES

MISSION FUEL	=	1699.
RESERVE FUEL	=	85.
TRAPPED FUEL	=	20.
TOTAL FUEL	=	1804.

TAKEOFF FUEL
WFTO1 = 56.
WFTO2 = 116.

FUEL CARRIED :
EXTERNALLY = 0.
INTERNALLY = 1804.

ADDITIONAL COMBAT PARAMETERS

	CONDITIONS	PS	NZ	TDOT	RADIUS	ALPHA	CL	CD
M= 1.60	1 G FLIGHT	848.2	1.00	0.00	0.	0.76	0.025	0.0345
H=30000.	SUSTAINED	0.0	6.85	7.85	11619.	4.73	0.165	0.0475
	MAX. INST.	-835.1	10.00	11.52	7915.	6.20	0.221	0.0573

COMBAT ENERGY = 0.203564E+06

BLOCK TIME	=	1.337	HOURS
BLOCK RANGE	=	559.5	N. M.
TAKEOFF FIELD LENGTH(TOTAL RUN)	=	2417.	FEET
LANDING FIELD LENGTH(TOTAL RUN)	=	12617.	FEET
LANDING FIELD LENGTH(GROUND RUN)	=	2742.	FEET
WEIGHT FOR LANDING CALCULATION	=	3978.	POUNDS
LANDING THRUST TO WEIGHT RATIO	=	*2.388*	
TAKEOFF WEIGHT	=	4994.	POUNDS
LANDING WEIGHT	=	3295.	POUNDS

CALLING MODULE NUMBER 3
Detailed Aerodynamics Output

Mach = 0.60
Altitude = 10000.

Parasite Drag		Induced Drag								
Friction	.0055	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0016	0.0	0.000	0.0070	0.0	0.000	0.00	0.0000	0.0	3
Wing	.0032	3.0	0.268	0.0157	17.1	0.029	0.48	0.0000	0.0	3
Strakes	.0000	6.0	0.512	0.0440	11.7	0.053	0.41	0.0000	0.0	3
H. Tail	.0000	0.0	0.000	0.0070	0.0	0.000	0.00	0.0000	0.0	3
V. Tail	.0005	9.0	0.732	0.0910	8.1	0.072	0.37	0.0000	0.0	3
Canard	.0003	12.0	0.927	0.1544	6.0	0.087	0.34	0.0000	0.0	3
Pods	.0000	15.0	1.096	0.2316	4.7	0.099	0.31	0.0000	0.0	3
Engine	.0000	18.0	1.240	0.3198	3.9	0.108	0.28	0.0000	0.0	3
Cowl	.0000	21.0	1.363	0.4193	3.3	0.115	0.26	0.0000	0.0	3
Boattail	.0000	24.0	1.474	0.5421	2.7	0.121	0.24	0.0000	0.0	3
Interference	.0015									
Wave	.0000									
External	.0000									
Tanks	.0000									
Bombs	.0000									

Slope Factors

ClAlpha	0.0614
Cdl^.5Alpha	0.0305

Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0070

FOR AN OBLIQUE WING

SWEEP = 0.00
YAWED ASPECT RATIO = 5.50
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 0.00
SWEPT ASPECT RATIO = 5.50
DRAG RISE MACH NO. = 0.000

Mach = 0.70
Altitude = 30000.

Parasite Drag		Induced Drag								
Friction	.0054	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0016	0.0	0.000	0.0069	0.0	0.000	0.00	0.0000	0.0	3
Wing	.0031	3.0	0.280	0.0165	16.9	0.024	0.47	0.0000	0.0	3
Strakes	.0000	6.0	0.535	0.0475	11.3	0.043	0.41	0.0000	0.0	3
H. Tail	.0000	0.0	0.000	0.0069	0.0	0.000	0.00	0.0000	0.0	3
V. Tail	.0005	9.0	0.764	0.0985	7.8	0.058	0.37	0.0000	0.0	3
Canard	.0003	12.0	0.967	0.1670	5.8	0.069	0.34	0.0000	0.0	3
Pods	.0000	15.0	1.143	0.2498	4.6	0.077	0.31	0.0000	0.0	3
Engine	.0000	18.0	1.294	0.3440	3.8	0.083	0.29	0.0000	0.0	3
Cowl	.0000	21.0	1.421	0.4497	3.2	0.087	0.26	0.0000	0.0	3
Boattail	.0000	24.0	1.537	0.5795	2.7	0.090	0.24	0.0000	0.0	3
Interference	.0015									
Wave	.0000									
External	.0000									
Tanks	.0000									
Bombs	.0000									
Stores	.0000									
Extra	.0000									
Camber	.0000									
Cdmin	.0069									

Slope Factors	
ClAlpha	0.0640
Cdl^.5Alpha	0.0315

FOR AN OBLIQUE WING

SWEEP = 0.05
YAWED ASPECT RATIO = 5.50
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 0.05
SWEPT ASPECT RATIO = 5.50
DRAG RISE MACH NO. = 0.000

Detailed Aerodynamics Output

Mach = 0.80
Altitude = 30000.

Parasite Drag		Induced Drag								
Friction	.0049	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0015	0.0	0.000	0.0063	0.0	0.000	0.00	0.0000	0.0	3
Wing	.0026	3.0	0.241	0.0149	16.1	-.002	0.50	0.0000	0.0	3
Strakes	.0000	6.0	0.459	0.0420	10.9	-.005	0.44	0.0000	0.0	3
H. Tail	.0000	0.0	0.000	0.0063	0.0	0.000	0.00	0.0000	0.0	3
V. Tail	.0005	9.0	0.655	0.0862	7.6	-.009	0.40	0.0000	0.0	3
Canard	.0003	12.0	0.829	0.1453	5.7	-.014	0.37	0.0000	0.0	3
Pods	.0000	15.0	0.981	0.2167	4.5	-.019	0.34	0.0000	0.0	3
Engine	.0000	18.0	1.112	0.2980	3.7	-.024	0.31	0.0000	0.0	3
Cowl	.0000	21.0	1.226	0.3899	3.1	-.030	0.29	0.0000	0.0	3
Boattail	.0000	24.0	1.335	0.5062	2.6	-.037	0.26	0.0000	0.0	3
Interference	.0015									
Wave	.0000									
External	.0000									
Tanks	.0000									
Bombs	.0000									
Stores	.0000									
Extra	.0000									
Camber	.0000									
Cdmin	.0063									

Slope Factors

ClAlpha	0.0556
Cdl^.5Alpha	0.0295

FOR AN OBLIQUE WING

SWEEP = 29.01
YAWED ASPECT RATIO = 4.31
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 29.01
SWEPT ASPECT RATIO = 4.31
DRAG RISE MACH NO. = 0.000

Mach = 0.90
Altitude = 30000.

Parasite Drag		Induced Drag								
Friction	.0046	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0015	0.0	0.000	0.0061	0.0	0.000	0.00	0.0000	0.0	3
Wing	.0024	3.0	0.213	0.0140	15.2	-.007	0.52	0.0000	0.0	3
Strakes	.0000	6.0	0.405	0.0385	10.5	-.015	0.46	0.0000	0.0	3
H. Tail	.0000	0.0	0.000	0.0061	0.0	0.000	0.00	0.0000	0.0	3
V. Tail	.0005	9.0	0.577	0.0783	7.4	-.023	0.42	0.0000	0.0	3
Canard	.0003	12.0	0.729	0.1310	5.6	-.031	0.39	0.0000	0.0	3
Pods	.0000	15.0	0.864	0.1944	4.4	-.040	0.36	0.0000	0.0	3
Engine	.0000	18.0	0.981	0.2668	3.7	-.048	0.34	0.0000	0.0	3
Cowl	.0000	21.0	1.085	0.3492	3.1	-.057	0.31	0.0000	0.0	3
Boattail	.0000	24.0	1.241	0.5258	2.4	-.074	0.27	0.0000	0.0	3
Interference	.0015									
Wave	.0000									
External	.0000									
Tanks	.0000									
Bombs	.0000									

Slope Factors

ClAlpha	0.0517
Cdl^.5Alpha	0.0300

Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0061

FOR AN OBLIQUE WING

SWEEP = 38.99
YAWED ASPECT RATIO = 3.49
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 38.99
SWEPT ASPECT RATIO = 3.49
DRAG RISE MACH NO. = 0.000

Detailed Aerodynamics Output

Mach = 1.00
Altitude = 30000.

Parasite Drag		Induced Drag								
Friction	.0044	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0015	0.0	0.000	0.0346	0.0	0.000	0.00	0.0000	0.0	3
Wing	.0022	3.0	0.192	0.0420	4.6	-.010	0.54	0.0000	0.0	3
Strakes	.0000	6.0	0.365	0.0648	5.6	-.020	0.48	0.0000	0.0	3
H. Tail	.0000	0.0	0.000	0.0346	0.0	0.000	0.00	0.0000	0.0	3
V. Tail	.0005	9.0	0.519	0.1014	5.1	-.031	0.44	0.0000	0.0	3
Canard	.0002	12.0	0.656	0.1497	4.4	-.041	0.41	0.0000	0.0	3
Pods	.0000	15.0	0.824	0.2375	3.5	-.064	0.37	0.0000	0.0	3
Engine	.0000	18.0	0.930	0.3133	3.0	-.080	0.34	0.0000	0.0	3
Cowl	.0000	21.0	1.024	0.3992	2.6	-.096	0.31	0.0000	0.0	3
Boattail	.0000	24.0	1.109	0.5017	2.2	-.111	0.29	0.0000	0.0	3
Interference	.0003									
Wave	.0298									
External	.0000									
Tanks	.0000									
Bombs	.0000									
Stores	.0000									
Extra	.0000									
Camber	.0000									
Cdmin	.0346									

Slope Factors

ClAlpha	0.0462
Cdl^.5Alpha	0.0285

FOR AN OBLIQUE WING

SWEEP = 45.62
YAWED ASPECT RATIO = 2.91
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 45.62
SWEPT ASPECT RATIO = 2.91
DRAG RISE MACH NO. = 0.000

Mach = 1.20
Altitude = 30000.

Parasite Drag	
Friction	.0041
Body	.0014
Wing	.0020
Strakes	.0000
H. Tail	.0000
V. Tail	.0004
Canard	.0002
Pods	.0000
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0002
Wave	.0317
External	.0000
Tanks	.0000
Bombs	.0000
Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0360

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.000	0.0360	0.0	0.000	0.00	0.0000	0.0	5
3.0	0.170	0.0444	3.8	0.000	0.51	0.0000	0.0	5
6.0	0.364	0.0742	4.9	0.000	0.51	0.0000	0.0	6
0.0	0.000	0.0360	0.0	0.000	0.00	0.0000	0.0	5
9.0	0.394	0.0911	4.3	0.000	0.42	0.0000	0.0	6
12.0	0.493	0.1274	3.9	0.000	0.39	0.0000	0.0	6
15.0	0.611	0.1778	3.4	0.000	0.39	0.0000	0.0	6
18.0	0.741	0.2468	3.0	0.000	0.39	0.0000	0.0	6
21.0	0.878	0.3362	2.6	0.000	0.38	0.0000	0.0	6
24.0	1.008	0.4414	2.3	0.000	0.37	0.0000	0.0	6

Slope Factors	
ClAlpha	0.0420
Cdl^.5Alpha	0.0265

FOR AN OBLIQUE WING

SWEEP = 54.36
YAWED ASPECT RATIO = 2.15
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 54.36
SWEPT ASPECT RATIO = 2.15
DRAG RISE MACH NO. = 0.000

Detailed Aerodynamics Output

Mach = 1.40
Altitude = 30000.

Parasite Drag	
Friction	.0038
Body	.0013
Wing	.0018
Strakes	.0000
H. Tail	.0000
V. Tail	.0004
Canard	.0002
Pods	.0000
Engine	.0000
Cowl	.0000
Boattail	.0000
Interference	.0002
Wave	.0311
External	.0000
Tanks	.0000
Bombs	.0000

Induced Drag

Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
0.0	0.000	0.0351	0.0	0.000	0.00	0.0000	0.0	5
3.0	0.100	0.0403	2.5	0.000	0.36	0.0000	0.0	5
6.0	0.210	0.0563	3.7	0.000	0.39	0.0000	0.0	5
0.0	0.000	0.0351	0.0	0.000	0.00	0.0000	0.0	5
9.0	0.318	0.0821	3.9	0.000	0.40	0.0000	0.0	6
12.0	0.437	0.1199	3.6	0.000	0.42	0.0000	0.0	6
15.0	0.560	0.1695	3.3	0.000	0.44	0.0000	0.0	6
18.0	0.687	0.2325	3.0	0.000	0.45	0.0000	0.0	6
21.0	0.831	0.3183	2.6	0.000	0.46	0.0000	0.0	6
24.0	0.971	0.4201	2.3	0.000	0.46	0.0000	0.0	6

Slope Factors	
ClAlpha	0.0405
Cdl^.5Alpha	0.0259

Stores	.0000
Extra	.0000
Camber	.0000
Cdmin	.0351

FOR AN OBLIQUE WING

SWEEP = 60.00
YAWED ASPECT RATIO = 1.70
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 60.00
SWEPT ASPECT RATIO = 1.70
DRAG RISE MACH NO. = 0.000

Mach = 1.60
Altitude = 30000.

Parasite Drag		Induced Drag								
Friction	.0036	Alpha	Cl	Cd	L/D	Cm	e	Cdtrim	Deltrim	Zone
Body	.0013	0.0	0.000	0.0341	0.0	0.000	0.00	0.0000	0.0	5
Wing	.0017	3.0	0.102	0.0394	2.6	0.000	0.37	0.0000	0.0	5
Strakes	.0000	6.0	0.214	0.0558	3.8	0.000	0.40	0.0000	0.0	5
H. Tail	.0000	0.0	0.000	0.0341	0.0	0.000	0.00	0.0000	0.0	5
V. Tail	.0004	9.0	0.333	0.0840	4.0	0.000	0.42	0.0000	0.0	5
Canard	.0002	12.0	0.456	0.1242	3.7	0.000	0.43	0.0000	0.0	5
Pods	.0000	15.0	0.563	0.1710	3.3	0.000	0.43	0.0000	0.0	6
Engine	.0000	18.0	0.689	0.2347	2.9	0.000	0.44	0.0000	0.0	6
Cowl	.0000	21.0	0.830	0.3202	2.6	0.000	0.45	0.0000	0.0	6
Boattail	.0000	24.0	0.973	0.4249	2.3	0.000	0.45	0.0000	0.0	6
Interference	.0002									
Wave	.0304									
External	.0000									
Tanks	.0000									
Bombs	.0000									
Stores	.0000									
Extra	.0000									
Camber	.0000									
Cdmin	.0341									

Slope Factors	
ClAlpha	0.0405
Cdl^.5Alpha	0.0260

FOR AN OBLIQUE WING

SWEEP = 60.00
YAWED ASPECT RATIO = 1.70
DRAG RISE MACH NO. = 0.000

FOR VARIABLE SWEEP

SWEEP = 60.00
SWEPT ASPECT RATIO = 1.70
DRAG RISE MACH NO. = 0.000
CALLING MODULE NUMBER 4

ENGINE SUMMARY

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ENGINE DIAMETER =   1.81 FEET
ENGINE LENGTH=  5.27 FEET
ENGINE WEIGHT=   841.06 POUNDS
BYPASS RATIO =  0.00
NO OF ENGINES PER AC =   1.
A/C DRAG REF AREA =   160.00 SQ FEET
INLET CAPTURE AREA PER ENG =   1.587 SQ FEET
PWCC    = PERCENT OF ENGINE CORRECTED AIRFLOW
THRUST = ENGINE THRUST (POUNDS PER ENGINE)
SFC     = ENGINE SPECIFIC FUEL CONSUMPTION
WTOT    = ENGINE TOTAL AIRFLOW (LBS/SEC PER ENGINE)
OV EF   = ENGINE OVERALL EFFICIENCY
PR EF   = ENGINE PROPULSIVE EFFICIENCY
TPR     = INLET TOTAL PRESSURE RECOVERY (TO EN FACE)
NPR     = NOZZLE PRESSURE RATIO
TIT     = TURBINE INLET TEMPERATURE (DEG R)
EGT     = ENGINE EXHAUST GAS TEMPERATURE
CPR     = OVERALL COMPRESSOR PRESSURE RATIO
THRUSTU= THRUST PER ENGINE IN LBS, W/O INSTAL DRAG CORR
SFCU    = SFC,1/HR, W/O INSTALLATION DRAG CORR
ABYAC   = FREESTREAM BYPASS FLOW AREA/AC
ABLAC   = FREESTREAM INLET BLEED FLOW AREA/AC
ANOZ    = AREA OF NOZZLE EXIT, FT**2
BETA    = NOZZLE BOATTAIL ANGLE IN DEGREES
AO/AC   = FREE STREAM TO CAPTURE AREA RATIO
CDINS   = TOT INSTALLATION DRAG COEF PER A/C (SWING REF)
CDADD   = ADDITIVE DRAG COEF PER A/C (SWING REF)
CDSP    = SUBSONIC SPILL DRAG COEFF PER A/C (SWING REF)
CDBL    = INLET BLEED DRAG COEF PER A/C (SWING REF)
CDBP    = INLET BYPASS DRAG PER A/C (SWING REF)
CDAUX   = AUX AIR SYSTEM DRAG COEF PER A/C (SWING REF)
CDDIV   = INLET BO. LAYER DIVERT DRAG PER A/C (SWING REF)
CDBT    = NOZZLE BOATTAIL DRAG COEF PER A/C (SWING REF)
CDINF   = DRAG COEF OF BASE AREA BETWEEN NOZZLES (PER A/C)

 INSTALL DRAG COEF SCALE FACTORS
SFINSP =      1.0000
SFADP  =      1.0000
SFADSP =      1.0000
SFBEP  =      1.0000
SFBPP  =      1.0000
SFAUXP =      1.0000
SFDIVP =      1.0000
SFIP   =      0.0000
SFBTP  =      0.0000
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MACH = 0.000 ALTITUDE = 0.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAOX	CDDIV	CDBT	CDINF
100.0	6844.	0.816	74.	0.000	0.000	1.000	4.95	2600.	1917.	22.54
	6844.	0.816	0.000	0.000	3.12	15.89				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
98.0	6268.	0.781	73.	0.000	0.000	1.000	4.45	2457.	1782.	21.47
	6268.	0.781	0.000	0.000	3.12	15.89				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
96.0	5711.	0.747	71.	0.000	0.000	1.000	3.99	2319.	1653.	20.44
	5711.	0.747	0.000	0.000	3.12	15.86				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
94.0	5171.	0.714	70.	0.000	0.000	1.000	3.56	2188.	1530.	19.43
	5171.	0.714	0.000	0.000	3.12	15.78				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
92.0	4648.	0.681	68.	0.000	0.000	1.000	3.15	2062.	1413.	18.47
	4648.	0.681	0.000	0.000	3.12	15.65				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90.0	4135.	0.650	67.	0.000	0.000	1.000	2.77	1943.	1302.	17.53
	4135.	0.650	0.000	0.000	3.12	15.44				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
88.0	3636.	0.620	65.	0.000	0.000	1.000	2.42	1829.	1197.	16.64
	3636.	0.620	0.000	0.000	3.12	15.14				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
86.0	3142.	0.593	64.	0.000	0.000	1.000	2.10	1721.	1098.	15.77
	3142.	0.593	0.000	0.000	3.12	14.68				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
84.0	2646.	0.572	63.	0.000	0.000	1.000	1.81	1618.	1005.	14.94
	2646.	0.572	0.000	0.000	3.12	13.99				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
82.0	2135.	0.562	61.	0.000	0.000	1.000	1.55	1521.	918.	14.13
	2135.	0.562	0.000	0.000	3.12	12.87				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

80.0	1580.	0.583	60.	0.000	0.000	1.000	1.31	1429.	836.	13.37
	1580.	0.583	0.000	0.000	3.12	10.80				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
78.0	877.	0.767	58.	0.000	0.000	1.000	1.10	1342.	761.	12.63
	877.	0.767	0.000	0.000	3.12	4.93				
	1000.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MACH = 0.600 ALTITUDE = 10000.00 FEET

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	5041.	0.970	65.	0.166	0.357	1.000	6.31	2596.	1914.	22.54
	5041.	0.970	0.000	0.000	3.12	14.89				
	1.126	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
98.0	4558.	0.941	64.	0.171	0.375	1.000	5.68	2452.	1779.	21.47
	4558.	0.941	0.000	0.000	3.12	14.92				
	1.104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
96.0	4093.	0.913	63.	0.176	0.394	1.000	5.09	2315.	1650.	20.44
	4093.	0.913	0.000	0.000	3.12	14.93				
	1.081	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
94.0	3645.	0.887	61.	0.181	0.416	1.000	4.53	2184.	1527.	19.43
	3645.	0.887	0.000	0.000	3.12	14.91				
	1.059	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
92.0	3213.	0.863	60.	0.186	0.441	1.000	4.02	2059.	1411.	18.47
	3213.	0.863	0.000	0.000	3.12	14.85				
	1.036	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90.0	2795.	0.842	59.	0.191	0.469	1.000	3.53	1940.	1300.	17.53
	2795.	0.842	0.000	0.000	3.12	14.72				
	1.014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
88.0	2391.	0.826	58.	0.195	0.502	1.000	3.09	1826.	1195.	16.64
	2391.	0.826	0.000	0.000	3.12	14.53				
	0.991	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
86.0	1997.	0.818	56.	0.197	0.540	1.000	2.68	1718.	1096.	15.77
	1997.	0.818	0.000	0.000	3.12	14.25				
	0.969	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

84.0	1610.	0.824	55.	0.195	0.587	1.000	2.31	1615.	1003.	14.94
	1610.	0.824	0.000	0.000	3.12	13.82				
	0.946	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
82.0	1224.	0.859	54.	0.187	0.646	1.000	1.97	1518.	916.	14.13
	1225.	0.859	0.000	0.000	3.12	13.17				
	0.924	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
80.0	831.	0.970	52.	0.166	0.725	1.000	1.67	1426.	835.	13.37
	831.	0.970	0.000	0.000	3.12	12.14				
	0.901	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
78.0	411.	1.435	51.	0.112	0.844	1.000	1.40	1339.	759.	12.63
	411.	1.435	0.000	0.000	3.12	10.32				
	0.879	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MACH = 0.800 ALTITUDE = 30000.00 FEET

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	2480.	0.936	36.	0.212	0.432	1.000	7.45	2328.	1700.	22.54
	2480.	0.936	0.000	0.000	3.12	14.05				
	0.985	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
98.0	2236.	0.910	35.	0.218	0.452	1.000	6.71	2199.	1580.	21.47
	2236.	0.910	0.000	0.000	3.12	14.11				
	0.965	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
96.0	2000.	0.886	34.	0.224	0.473	1.000	6.00	2076.	1464.	20.44
	2000.	0.886	0.000	0.000	3.12	14.14				
	0.945	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
94.0	1774.	0.863	34.	0.230	0.497	1.000	5.34	1959.	1355.	19.43
	1774.	0.863	0.000	0.000	3.12	14.15				
	0.926	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
92.0	1557.	0.843	33.	0.235	0.523	1.000	4.72	1846.	1250.	18.47
	1557.	0.843	0.000	0.000	3.12	14.12				
	0.906	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
90.0	1349.	0.826	32.	0.240	0.553	1.000	4.15	1739.	1152.	17.53
	1349.	0.826	0.000	0.000	3.12	14.04				
	0.886	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

88.0	1147.	0.814	31.	0.243	0.587	1.000	3.63	1638.	1058.	16.64
	1147.	0.814	0.000	0.000	3.12	13.90				
	0.866	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
86.0	952.	0.810	31.	0.244	0.625	1.000	3.15	1541.	971.	15.77
	952.	0.810	0.000	0.000	3.12	13.68				
	0.847	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
84.0	761.	0.821	30.	0.241	0.671	1.000	2.71	1449.	888.	14.94
	761.	0.821	0.000	0.000	3.12	13.35				
	0.827	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
82.0	574.	0.862	29.	0.230	0.726	1.000	2.31	1362.	811.	14.13
	574.	0.862	0.000	0.000	3.12	12.86				
	0.807	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
80.0	387.	0.978	29.	0.203	0.795	1.000	1.95	1279.	739.	13.37
	387.	0.978	0.000	0.000	3.12	12.10				
	0.788	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
78.0	194.	1.417	28.	0.140	0.889	1.000	1.64	1201.	672.	12.63
	194.	1.416	0.000	0.000	3.12	10.88				
	0.768	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MACH = 1.000 ALTITUDE = 30000.00 FEET

AFTERBURNER OR DUCTBURNER (OR BOTH) LIT

PWCC	THRUST THRUSTU AO/AC	SFC SFCU CDINS	WTOT ABYAC CDADD	OV EF ABLAC CDSP	PR EF ANOZ CDBL	TPR BETA CDBP	NPR CDAUX	TIT CDDIV	EGT CDBT	CPR CDINF
100.0	4899.	1.661	43.	0.151	0.384	1.000	9.32	2478.	1820.	22.54
	4954.	1.643	0.000	0.000	3.12	9.76				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4786.	1.624	43.	0.154	0.388	1.000	9.32	2478.	1820.	22.54
	4841.	1.605	0.000	0.000	3.12	9.93				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4672.	1.586	43.	0.158	0.392	1.000	9.32	2478.	1820.	22.54
	4727.	1.567	0.000	0.000	3.12	10.10				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4557.	1.547	43.	0.162	0.397	1.000	9.32	2478.	1820.	22.54
	4612.	1.529	0.000	0.000	3.12	10.27				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000

100.0	4442.	1.509	43.	0.166	0.401	1.000	9.32	2478.	1820.	22.54
	4497.	1.490	0.000	0.000	3.12	10.45				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4325.	1.470	43.	0.171	0.406	1.000	9.32	2478.	1820.	22.54
	4380.	1.452	0.000	0.000	3.12	10.63				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4207.	1.431	43.	0.175	0.411	1.000	9.32	2478.	1820.	22.54
	4262.	1.412	0.000	0.000	3.12	10.81				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4088.	1.391	43.	0.180	0.416	1.000	9.32	2478.	1820.	22.54
	4143.	1.372	0.000	0.000	3.12	11.00				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3968.	1.350	43.	0.186	0.422	1.000	9.32	2478.	1820.	22.54
	4023.	1.332	0.000	0.000	3.12	11.20				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3847.	1.310	43.	0.192	0.428	1.000	9.32	2478.	1820.	22.54
	3902.	1.291	0.000	0.000	3.12	11.40				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3724.	1.268	43.	0.198	0.434	1.000	9.32	2478.	1820.	22.54
	3779.	1.250	0.000	0.000	3.12	11.61				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3599.	1.226	43.	0.205	0.441	1.000	9.32	2478.	1820.	22.54
	3654.	1.207	0.000	0.000	3.12	11.83				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3473.	1.183	43.	0.213	0.448	1.000	9.32	2478.	1820.	22.54
	3528.	1.164	0.000	0.000	3.12	12.05				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3345.	1.139	43.	0.221	0.455	1.000	9.32	2478.	1820.	22.54
	3400.	1.120	0.000	0.000	3.12	12.28				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3216.	1.093	43.	0.230	0.463	1.000	9.32	2478.	1820.	22.54
	3271.	1.075	0.000	0.000	3.12	12.52				
	0.948	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000

MACH = 1.200 ALTITUDE = 30000.00 FEET

AFTERBURNER OR DUCTBURNER (OR BOTH) LIT

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	5925.	1.660	53.	0.181	0.433	0.991	11.46	2600.	1901.	22.54
	6004.	1.638	0.000	0.000	3.12	8.48				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	5781.	1.624	53.	0.186	0.438	0.991	11.46	2600.	1901.	22.54
	5860.	1.602	0.000	0.000	3.12	8.65				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	5636.	1.587	53.	0.190	0.442	0.991	11.46	2600.	1901.	22.54
	5715.	1.565	0.000	0.000	3.12	8.83				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	5490.	1.550	53.	0.195	0.447	0.991	11.46	2600.	1901.	22.54
	5569.	1.528	0.000	0.000	3.12	9.01				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	5343.	1.512	53.	0.199	0.452	0.991	11.46	2600.	1901.	22.54
	5422.	1.490	0.000	0.000	3.12	9.20				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	5195.	1.474	53.	0.205	0.457	0.991	11.46	2600.	1901.	22.54
	5274.	1.452	0.000	0.000	3.12	9.39				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	5045.	1.436	53.	0.210	0.462	0.991	11.46	2600.	1901.	22.54
	5124.	1.414	0.000	0.000	3.12	9.58				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4894.	1.397	53.	0.216	0.468	0.991	11.46	2600.	1901.	22.54
	4973.	1.375	0.000	0.000	3.12	9.79				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4741.	1.358	53.	0.222	0.474	0.991	11.46	2600.	1901.	22.54
	4820.	1.336	0.000	0.000	3.12	9.99				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4586.	1.318	53.	0.229	0.480	0.991	11.46	2600.	1901.	22.54
	4665.	1.296	0.000	0.000	3.12	10.21				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000

100.0	4430.	1.277	53.	0.237	0.487	0.991	11.46	2600.	1901.	22.54
	4509.	1.255	0.000	0.000	3.12	10.43				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4272.	1.236	53.	0.245	0.494	0.991	11.46	2600.	1901.	22.54
	4351.	1.213	0.000	0.000	3.12	10.65				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	4112.	1.193	53.	0.254	0.501	0.991	11.46	2600.	1901.	22.54
	4191.	1.171	0.000	0.000	3.12	10.89				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3949.	1.150	53.	0.264	0.509	0.991	11.46	2600.	1901.	22.54
	4028.	1.127	0.000	0.000	3.12	11.13				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000
100.0	3784.	1.105	53.	0.274	0.517	0.991	11.46	2600.	1901.	22.54
	3863.	1.083	0.000	0.000	3.12	11.39				
	0.968	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0008	0.0000	0.0000

MACH = 1.600 ALTITUDE = 30000.00 FEET

AFTERBURNER OR DUCTBURNER (OR BOTH) LIT

PWCC	THRUST	SFC	WTOT	OV EF	PR EF	TPR	NPR	TIT	EGT	CPR
	THRUSTU	SFCU	ABYAC	ABLAC	ANOZ	BETA				
	AO/AC	CDINS	CDADD	CDSP	CDBL	CDBP	CDAUX	CDDIV	CDBT	CDINF
100.0	8601.	1.741	82.	0.231	0.530	0.954	14.37	2600.	1780.	22.54
	8733.	1.715	0.000	0.000	3.12	4.07				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	8369.	1.706	82.	0.236	0.534	0.954	14.37	2600.	1780.	22.54
	8500.	1.680	0.000	0.000	3.12	4.28				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	8134.	1.671	82.	0.241	0.539	0.954	14.37	2600.	1780.	22.54
	8266.	1.644	0.000	0.000	3.12	4.48				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	7898.	1.635	82.	0.246	0.545	0.954	14.37	2600.	1780.	22.54
	8030.	1.608	0.000	0.000	3.12	4.70				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000

100.0	7661.	1.599	82.	0.252	0.550	0.954	14.37	2600.	1780.	22.54
	7793.	1.572	0.000	0.000	3.12	4.92				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	7421.	1.562	82.	0.258	0.556	0.954	14.37	2600.	1780.	22.54
	7553.	1.535	0.000	0.000	3.12	5.14				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	7179.	1.526	82.	0.264	0.562	0.954	14.37	2600.	1780.	22.54
	7311.	1.498	0.000	0.000	3.12	5.38				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	6935.	1.488	82.	0.271	0.568	0.954	14.37	2600.	1780.	22.54
	7067.	1.460	0.000	0.000	3.12	5.61				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	6688.	1.450	82.	0.279	0.574	0.954	14.37	2600.	1780.	22.54
	6820.	1.422	0.000	0.000	3.12	5.86				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	6439.	1.412	82.	0.286	0.581	0.954	14.37	2600.	1780.	22.54
	6571.	1.383	0.000	0.000	3.12	6.11				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	6187.	1.372	82.	0.295	0.589	0.954	14.37	2600.	1780.	22.54
	6319.	1.344	0.000	0.000	3.12	6.37				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	5932.	1.332	82.	0.304	0.596	0.954	14.37	2600.	1780.	22.54
	6064.	1.303	0.000	0.000	3.12	6.64				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	5673.	1.291	82.	0.314	0.604	0.954	14.37	2600.	1780.	22.54
	5805.	1.262	0.000	0.000	3.12	6.91				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	5411.	1.249	82.	0.325	0.613	0.954	14.37	2600.	1780.	22.54
	5543.	1.219	0.000	0.000	3.12	7.20				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000
100.0	5146.	1.205	82.	0.337	0.622	0.954	14.37	2600.	1780.	22.54
	5278.	1.175	0.000	0.000	3.12	7.50				
	1.129	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0000	0.0000

SEA-LEVEL STATIC THRUST = 9500. (MAX)
SEA-LEVEL SFC = 1.468
CALLING MODULE NUMBER 6

WEIGHT STATEMENT - FIGHTERS
*** WEIGHTS DATA ***
ACSYNT MODULE NUMBER 6

COMPONENT	POUNDS	KILOGRAMS	PERCENT
AIRFRAME STRUCTURE	1138.	516.	22.79
WING	421.	191.	8.43
FUSELAGE	535.	243.	10.71
HORIZONTAL TAIL	0.	0.	0.00
VERTICAL TAIL	50.	23.	1.01
CANARD	17.	8.	0.34
NACELLES	13.	6.	0.26
ALIGHTING GEAR	102.	46.	2.05
PROPULSION	1093.	496.	21.89
ENGINES (1)	976.	443.	19.53
FUEL SYSTEM	118.	53.	2.36
FIXED EQUIPMENT	559.	254.	11.19
HYD. + PNEU.	42.	19.	0.84
ELECTRICAL	90.	41.	1.80
AVIONICS	210.	95.	4.20
INSTRUMENTATION	29.	13.	0.58
DE-ICE/AIR CONDITION	0.	0.	0.00
AUXILIARY GEAR	26.	12.	0.53
FURNISH. + EQPT.	0.	0.	0.00
FLIGHT CONTROLS	162.	73.	3.24
FUEL	1804.	818.	36.12
PAYLOAD	400.	181.	8.01
FLIGHT CREW (0)	0.	0.	0.00
ARMAMENT	0.	0.	0.00
AMMUNITION	0.	0.	0.00
MISSILES	0.	0.	0.00
BOMBS	0.	0.	0.00
EXTERNAL TANKS	0.	0.	0.00
ADV. WEAPONS 1	0.	0.	0.00
ADV. WEAPONS 2	0.	0.	0.00
CALCULATED WEIGHT	4994.	2265.	100.00
ESTIMATED WEIGHT	4994.	2265.	
PERCENT ERROR	0.00		

CALLING MODULE NUMBER 11

SUMMARY --- ACSYNT OUTPUT --- NASA, AMES RESEARCH CENTER

OBLIQUE WING UAV

GENERAL	
WG	4994.
W/S	31.2
T/W	1.90
N(Z) ULT	15.0
CREW	0.
PASENGERS	0.

FUSELAGE	
LENGTH	19.0
DIAMETER	3.0
VOLUME	101.7
WETTED AREA	166.6
FINENESS RATIO	6.3

	WING	CANARD	VTAIL
AREA	160.0	25.0	20.0
WETTED AREA	304.5	20.5	36.1
SPAN	29.7	7.7	7.7
L.E. SWEEP	5.6	30.0	32.3
C/4 SWEEP	0.0	21.7	27.6
ASPECT RATIO	5.50	2.40	3.00
TAPER RATIO	0.30	0.40	0.50
T/C ROOT	0.06	0.06	0.07
T/C TIP	0.06	0.06	0.06
ROOT CHORD	8.3	4.6	3.4
TIP CHORD	2.5	1.8	1.7
M.A. CHORD	5.9	3.4	2.7
LOC. OF L.E.	8.4	0.9	15.6

ENGINE	
NUMBER	1.
LENGTH	5.3
DIAM.	1.8
WEIGHT	841.1
TSLS	9500.
SFCSLS	1.47

WEIGHTS	W	WG
STRUCT.	1138.	22.8
PROPUL.	1093.	21.9
FIX. EQ.	559.	11.2
FUEL	1804.	36.1
PAYLOAD	400.	8.0

MISSION SUMMARY

PHASE	MACH	ALT	FUEL	TIME	DIST	L/D	THRUST	SFC	Q
TAKEOFF	0.00	0.	173.	5.5	2416.9				
CLIMB	0.94	30000.	49.	0.6	2.6	9.29	3282.6	1.004	389.8
CRUISE	0.80	30000.	182.	30.5	240.0	13.35	348.3	1.023	282.1
ACCEL	1.60	30000.	131.	0.7	9.3	0.72	8601.2	1.741	1128.4
COMBAT	1.60	30000.	892.	4.0	62.9	3.26	8061.2	1.660	1128.4
CRUISE	0.80	30000.	116.	20.4	160.0	10.91	320.7	1.063	282.1
DESCENT	0.26	0.	157.	24.0	84.7	17.37	434.5	1.286	100.8
LANDING					12617.1				

BLOCK TIME = 1.337 HR
BLOCK RANGE = 559.5 NM

COMBAT PHASES

MACH	ALT	PS1G	NZS	CLS	CDS	ALS	NZI	PSI	CLI	CDI	ALI	CBE
1.60	30000.	848.	6.9	0.145	0.0445	4.2	10.0	-835.	0.221	0.0573	6.2	203564.

XIV. TROUBLESHOOTING

A. OVERVIEW

While every effort has been made with CREATE to prevent errors from occuring with ACSYNT, crashes still occur, typically when working with a new design. When ACSYNT does crash, a printout like the one in Figure 8 occurs. This printout can be used in tracking down the probable source of the error so that a correction may be made. On the right side of the output is a listing of the ACSYNT subroutines that were in use at the time of the crash. The first

```
%TRACE-E-TRACEBACK, symbolic stack dump follows
module name   routine name                      line       rel PC    abs PC
                                                          0015E79E  0015E79E
                                                          0015E69B  0015E69B
                                                          0015A818  0015A818
PRODR          PRODR                             318      00001882  000F1686
PRODR1         PRODR1                              9      0000003E  000F45C6
PROPEXEC       PROPEXEC                           13      00000034  000F7FF8
OVER3          OVER3                              62      00000049  00105229
ACSCYC         ACSCYC                             92      000001D8  000DBFA0
ACSOUT         ACSOUT                             24      00000062  000DBABA
ANALIZ         ANALIZ                             30      00000080  000DB488
COPES          COPES                             247      000008E8  000CD6E8
```

Figure 8. Sample Error Output

subroutine (in this case PRODR) is the subroutine where the error occured. The ACSYNT "chain" traces down to COPES, the main entry point for ACSYNT. Knowing that the error occured in the PRODR subroutine lets the

user know that the probable cause lies with the Propulsion inputs. A listing of the subroutines for each Module of ACSYNT is given in the listings below. Note that the user does not have control over all of the Modules shown below, but they are given for completeness.

- ACSYNT Control: ACSCYC, ACSIN, ACSOUT, ANALIZ, AT62, CONVG, DATAIO, DATARD, SUMARY, SUMCVT, SUMPRT, TAINT
- Analysis Methods: COPES, COPE01 through COPE18, CONMIN, CNMN01 through CNMN08, OVER1
- Geometry Module: AVOL, AVWING, BDREQD, BDYOUT, BODY1, BODY2, CHECKR, CHECKX, CRWSIZ, ERROR, FUSFIT, GCALC2, GEOM1, GINIT, GINPUT, GPLOT, GPRINT, GREAD, LOCELE, LOCENG, LOCFUL, LOCREW, LOCPAY, OVER2, PASSIZ, PLOTA5, PLOTA6, PLOTA7, PLOTA8, PLOTV2, PODLOC, PRFUEL, PRINTOUT, SCANER, SIZE, STRCALC, SWPANG, TAILS, TAILXX, VOLWNG, WCOOR, WNGOUT
- Trajectory Module: ACCEL, CLIMB, COMBAT, CONVGR, CRUISE, DESCNT, FINDG, GOLDEN, LOITER, MAXRC, MISSION, OVER3, TAKEOF, TRAJA, TRAJDT, TRAJIN, TRAJOI, TRAJOO, TRPLOT
- Aerodynamics Module: AERO2, AEROX, AXE, AXEIN, AZROIN, BCLCD, BIV, COGEOM, DATIN, DATOUT, DECIDE, ENDRAG, EXTRDG, FDCLCD, FLAPS, FRCTN, FRICN, FUDGE, GEOM, GEOMB, GEOMC, GEOMN, GEOSET, INITIAL, INTERPOLATE, INTFDG, LIFT, MAIN, THERMO, TRIMDG, WAVE1, WAVE3, WAVEDG
- Propulsion Module: BRCKT1, BRCKT2, CDADDI, CDAUXI, CDBTA, CDBTAIL, CDBYPA, CDDIVI, CHLSKY, COMP, ENGCDI, ENGSET, ENGWT, GABSOIL, INPUT, INTRPL, LEWIS_ENGINE_SCALE, LSTSQR, MATMPY, OFFD1, PODGEO, PRINL, PRODR, PRODR1, PRODR2, PRODR3, PROP, PROPEXEC, PROUT, PRSUBS, SIZIN, TURBI, TURBOU, XINLET, XPODGEO, XZEROIN, ZEROIN
- Weights Module: WAVE00 through WAVE03

CREATE has removed virtually all probability of errors with the Geometry, Aerodynamics and Weights modules. Errors do occur with the Trajectory and Propulsion modules. The most common ones are given in the following sections.

B. TRAJECTORY ERRORS

Trajectory errors are almost always associated in some form with the propulsion system installed on the design, typically due to insufficient or too much thrust. Listed below are the more prevelant errors and the solutions.

- Mach Number Exceeds 2.0 in Climb Phase: When this occurs the rate of climb is set to 0.0, which results in an additional warning of "Ceiling Reached". This can occur for designs with a high thrust to weight ratio climbing at a high throttle setting. Reduce the throttle and if climbing more than 20,000 feet, try using two climb phases instead of 1.

- Drag is Greater than Thrust: This may be caused by several factors. The most common is to have a poorly defined geometry. A high thickness to chord ratio on a supersonic aircraft can result in a high wave drag, or the nose fineness ratio may not be high enough. Engine thrust also dies out as the mach number increases. Running a turbojet at speeds in excess of mach 2.4 is difficult with ACSYNT. If a swept wing is being used, ensure that the sweep is programmed correctly. Also ensure that the engine efficiencies are set correctly. This warning will also occur if the time is set to 0.0 during an acceleration phase.

C. PROPULSION ERRORS

The following error messages may occur with the Propulsion Module. The solutions are taken from Reference 4.

- P5 is Less Than P6S: The total pressure at the nozzle entrance is less than the free stream static pressure. This is the result of removing too much energy from the primary flow with the turbines. Increase the throttle setting, decrease the energy required for the fan or increase the altitude.

- Fuel-Air Mixture is Greater Than Stoich: The fuel-air mixture in the afterburner or ductburner is greater than stoichiometric. Reduce the combustion temperature.

- T5 is Less Than T4M: The afterburner entry temperature is less than the turbine exit temperature. Increase the afterburner combustion temperature.

- T7 is Less Than T11: The ductburner temperature is less than the fan exit temperature. Increase the ductburner combustion temperature.

- T41D is Negative: The turbine exit temperature is negative. The turbine inlet temperature is too low or too much energy is being removed by the turbine.

APPENDIX A

```
      PROGRAM CREATE
C ------------------------------------------------------------------
C --- THIS PROGRAM IS TO BE USED AS AN AID IN CREATING THE ACSYNT .ACS
C --- FILE. DEDICATED USERS OF ACSYNT WILL WANT TO BYPASS THIS PROGRAM
C --- AND EDIT THE '.ACS' FILE THEMSELVES.
C ---
C --- CREATE WAS DEVELOPED BY LT JOHN PARKER, NAVAL POSTGRADUATE
C --- SCHOOL, SPRING 1991
C ---
C ---
C ---  LIST OF VARIABLES (NON-ACSYNT SPECIFIC)
C ---
C --- ANS:    MISC QUESTION/ANSWER
C --- DVFLAG: FLAG TO USE THE DEFAULT VARIABLES (I.E. A NEW FILE IS
C ---         CREATED)
C --- EXT:    .ACS  (THIS IS ADDED ON TO THE FILENAME FOR THE FILE
C ---         (EXTENSION)
C --- FILE:   THE FILENAME WITH THE EXTENSION
C --- LV:     A LOGICAL VARIABLE THAT DETERMINES THE EXISTENCE OF A
C ---         FILE. IF TRUE THEN THE FILE EXISTS.
C --- NAME:   THE FILENAME WITHOUT THE EXTENSION
C --- NVFLAG: FLAG TURNING THE NAVY MODULE ON/OFF
C --- STFLAG: FLAG TURNING THE STABILITY MODULE ON/OFF
C --- TITLE:  THE PROJECT TITLE. ALSO USED AS A MISC 80 CHARACTER
C ---         VARIABLE
C --- TOFLAG: FLAG SETTING THE TAKE-OFF MODULE ON/OFF
C ---
C --- FILES: UNIT 7 = THE CURRENT .ACS DATA FILE
C ---        UNIT 10 = THE BACK-UP OF THE ORIGINAL DATA FILE
C ------------------------------------------------------------------
      CHARACTER ANS*6, EXT*4, FILE*10, NAME*6, TITLE*80, TEMP*3,
     &ATYPE*10
      LOGICAL LV, DVFLAG, STFLAG, TOFLAG, NVFLAG
      INTEGER GETLEN, AIDSGN, STATUS, LIB$SPAWN
      DIMENSION SNS(8), NSN(8), AIDSGN(20), NREAD(10), NEXEC(10),
     &NWRITE(10), VUB(50), VLB(50), TX(50), BL(50), BU(50), ICON(50)
      REAL LOWER
      EXT='.ACS'
      STFLAG=.FALSE.
      TOFLAG=.FALSE.
      DVFLAG=.FALSE.
      NVFLAG=.FALSE.
C ------------------------------------------------------------------
C --- SET-UP THE DATA FILE
C ------------------------------------------------------------------
    5 STATUS = LIB$SPAWN('CLS')
      WRITE(6,10)
   10 FORMAT(//
     &7X,'IF YOU HAVE NOT USED THIS PROGRAM BEFORE TO CREATE AN'/
     &7X,'ACSYNT DATA FILE, YOU SHOULD SELECT (2) IN THE MENU'/
     &7X,'BELOW.'//7X,'(1) READ A PREVIOUSLY CREATED FILE'/
     &7X,'(2) CREATE A NEW FILE'/
```

```
     &7X,'(3) QUIT'//7X,'SELECT 1, 2, OR 3: '$)
      READ(5,20) ANS
   20 FORMAT(A1)
      IF(ANS.EQ.'1') GOTO 50
      IF(ANS.EQ.'2') GOTO 100
      IF(ANS.EQ.'3') STOP
      GOTO 5
C --- OPEN A PREVIOUSLY CREATED FILE. IF THAT FILE DOES NOT EXIST,
C --- CHECK THE SPELLING AND TRY AGAIN. IF IT STILL DOES NOT EXIST,
C --- QUIT OR CREATE A NEW ONE
   50 WRITE(6,55)
   55 FORMAT(/7X,'ENTER THE NAME OF THE ACSYNT DATA FILE: ',$)
      READ(5,60) NAME
   60 FORMAT(A6)
      FILE=NAME(1:GETLEN(NAME))//EXT
      INQUIRE(FILE=FILE,EXIST=LV)
      IF(LV.EQ..TRUE.) THEN              ! THE FILE EXISTS
        OPEN(UNIT=7,FILE=FILE,BLANK='NULL',STATUS='OLD',
     &  ACCESS='SEQUENTIAL',FORM='FORMATTED')
      ELSE
        WRITE(6,65)
   65   FORMAT(/7X,'THAT FILE DOES NOT EXIST. CHECK YOUR SPELLING'/
     &  7X,'AND TRY AGAIN. DO NOT ADD THE 3 LETTER FILE EXTENSION'/
     &  /7X,'ENTER THE FILENAME: ',$)
        READ(5,60) NAME
        FILE=NAME(1:GETLEN(NAME))//EXT   ! GET RID OF THE BLANKS
        INQUIRE(FILE=FILE,EXIST=LV)
        IF(LV.EQ..FALSE.) THEN
   70     WRITE(6,75)
   75     FORMAT(/7X,'THAT FILE DOES NOT EXIST. WOULD YOU LIKE TO:'/
     &    7X,'(1) CREATE A NEW FILE'/7X,'(2) QUIT'//
     &    7X,'SELECT 1 OR 2: '$)
          READ(5,20) ANS
          IF(ANS.EQ.'1') GOTO 100
          IF(ANS.EQ.'2') STOP
          GOTO 70
        ELSE
          OPEN(UNIT=7,FILE=FILE,BLANK='NULL',STATUS='OLD',
     &    ACCESS='SEQUENTIAL',FORM='FORMATTED')
        ENDIF
      ENDIF
C --- OPEN A TEMPORARY FILE AND COPY THE ACS FILE TO IT. THIS WILL
C --- PREVENT DATA OVERWRITE AS THE ACS FILE IS UPDATED WITH THE
C --- NEW DATA. IT ALSO SERVES AS A BACK-UP FILE IN CASE THE CURRENT
C --- SESSION ENDS PREMATURELY
      OPEN(UNIT=10,FILE='TEMP.DAT',ACCESS='SEQUENTIAL',FORM='FORMATTED',
     &STATUS='UNKNOWN')
      REWIND(7)
      REWIND(10)
      DO 97 I=1,1000
        READ(7,90,END=95) TITLE
   90   FORMAT(A80)
        WRITE(10,90) TITLE
   97 CONTINUE
   95 GOTO 200
C --- CREATE A NEW FILE. CHECK TO SEE IF THAT FILENAME IS ALREADY
C --- BEING USED.
  100 WRITE(6,102)
  102 FORMAT(/7X,'ENTER THE FILENAME THAT YOU WISH'/
     &7X,'TO USE (UP TO 6 CHARACTERS): ',$)
```

```
      READ(5,60) NAME
      FILE=NAME(1:GETLEN(NAME))//EXT   ! GET RID OF THE BLANKS
      INQUIRE(FILE=FILE,EXIST=LV)
      IF(LV.EQ..TRUE.) THEN
        PRINT*,'       THAT FILENAME IS ALREADY IN USE'
        GOTO 100
      ELSE
        OPEN(UNIT=7,FILE=FILE,BLANK='NULL',STATUS='NEW',
     &  ACCESS='SEQUENTIAL',FORM='FORMATTED')
        DVFLAG=.TRUE.
      ENDIF
C -------------------------------------------------------------------
C --- THIS SECTION WILL ESTABLISH THE COPES DATA BLOCKS. IF THE FILE
C --- WAS PREVIOUSLY CREATED THEN AN OPTION IS GIVEN TO BYPASS THIS
C --- SECTION AND PROCEED TO THE ACSYNT CONTROL SECTION
C -------------------------------------------------------------------
  200 IF(DVFLAG.EQ..FALSE.) THEN
        STATUS = LIB$SPAWN('CLS')
        WRITE(6,205)
  205   FORMAT(//
     &  7X,'DO YOU WISH TO ALTER THE METHOD OF ANALYSIS?'/
     &  7X,'(THIS WOULD MEAN CHANGING THE DESIGN OR SENSITIVITY'/
     &  7X,'VARIABLES, OR A CHANGE IN THE CONSTRAINTS)'//
     &  7X,'(1) YES'/7X,'(2) NO'//
     &  7X,'SELECT 1 OR 2: '$)
        READ(5,20) ANS
C ---   IF THE ANSWER IS NO, THEN MOVE THE FILE POINTER TO THE TOP
C ---   OF THE ACSYNT CONTROL SECTION (BYPASSING COPES DATA)
        IF(ANS.EQ.'2') THEN
          REWIND(7)
          DO 215 I=1,50
          READ(7,210) ANS
  210     FORMAT(A3)
          IF(ANS.EQ.'END') GOTO 1000   ! END IS DATA BLOCK V RELATED
  215     CONTINUE
        ENDIF
        IF(ANS.NE.'1') GOTO 200
      ENDIF
  220 STATUS = LIB$SPAWN('CLS')
      WRITE(6,230)
  230 FORMAT(///
     &7X,'** ANALYSIS METHOD **'//
     &7X,'(1) SIMPLE ANALYSIS. (NO VARIABLE OPTIMIZATION AND'/
     &7X,'    NO CONSTRAINTS).'/
     &7X,'(2) OPTIMIZATION.  (OPTIMIZE A VARIABLE GIVEN A SET'/
     &7X,'    OF DESIGN VARIABLES)'/
     &7X,'(3) SENSITIVITY.  (DETERMINE THE EFFECT OF A SET OF'/
     &7X,'    VARIABLES ON THE BEHAVIOR OF ANOTHER VARIABLE)'//
     &7X,'SELECT 1, 2 OR 3: '$)
      READ(5,20) ANS
      IF(ANS.EQ.'1') GOTO 300
      IF(ANS.EQ.'2') GOTO 400
      IF(ANS.EQ.'3') GOTO 700
      GOTO 220
C ----------------------------------------------------------------------
C --- SIMPLE ANALYSIS
C --- NCALC=1, NDV=0, NSV=0, N2VAR=0, NXAPRX=0, IPNPUT=2, IPDBG=0
C --- DATA BLOCKS A, B AND V WILL BE COMPLETED
C ----------------------------------------------------------------------
  300 WRITE(6,305)
```

```
      SAFLAG=.TRUE.
  305 FORMAT(//7X,'ENTER A TITLE FOR THIS PROJECT (UP TO 80'/
     &7X,'CHARACTERS): ',$)
      READ(5,310) TITLE
  310 FORMAT(A80)
      REWIND(7)
      WRITE(7,320) TITLE
  320 FORMAT('$ DATA BLOCK A'/A80)
      WRITE(7,330)
  330 FORMAT('$ DATA BLOCK B'/'1,0,0,0,0,1,0')
      WRITE(7,340)
  340 FORMAT('$ DATA BLOCK V'/'END')
      GOTO 1000
C ----------------------------------------------------------------------
C --- OPTIMIZATION
C --- NCALC=2, NSV=0, N2VAR=0, NXAPRX=0, IPNPUT=2, IPDBUG=0, ALL OF
C --- DATA BLOCK C IS DEFAULTED, FDCH=.02, FDCHM=.001, CT=.04,
C --- CTMIN=.001,CTLMIN=-.01, THETA=1.0, DELFUN=.001, DABFUN=.001,
C --- ALPHX=0.1, ABOBJ1=0.1, NDVTOT=NDV, AMULT=1.0
C --- DATA BLOCKS A-I AND V WILL BE COMPLETED
C ----------------------------------------------------------------------
  400 WRITE(6,305)
      READ(5,310) TITLE
      REWIND(7)
      WRITE(7,320) TITLE
  404 STATUS = LIB$SPAWN('CLS')
      WRITE(6,405)
  405 FORMAT(/7X,'ENTER THE GLOBAL NUMBER OF THE OBJECTIVE VARIABLE'
     &/7X,'(THE OBJECTIVE VARIABLE IS THE ONE THAT WILL BE'/
     &7X,'OPTIMIZED BY ACSYNT): ',$)
      READ(5,410,ERR=404) IOBJ
  410 FORMAT(I3)
      IF((IOBJ.GT.999).OR.(IOBJ.LT.1)) GOTO 404
  420 WRITE(6,425)
  425 FORMAT(/7X,'DO YOU WISH TO MINIMIZE THE OBJECTIVE VARIABLE'/
     &7X,'OR MAXIMIZE IT?'//7X,'(1) MINIMIZE'/
     &7X,'(2) MAXIMIZE'//7X,'SELECT 1 OR 2: ',$)
      READ(5,20) ANS
      IF(ANS.EQ.'1') SGNOPT=-1.0
      IF(ANS.EQ.'2') SGNOPT=1.0
      IF((ANS.NE.'1').AND.(ANS.NE.'2')) GOTO 420
  430 STATUS = LIB$SPAWN('CLS')
      WRITE(6,435)
  435 FORMAT(//7X,'ENTER THE TOTAL NUMBER OF DESIGN VARIABLES'/
     &7X,'(THESE ARE THE VARIABLES THAT ACSYNT WILL MODIFY TO'/
     &7X,'OPTIMIZE THE OBJECTIVE): ',$)
      READ(5,410,ERR=430) NDV
      IF((NDV.GT.99).OR.(NDV.LT.1)) GOTO 430
      DO 500 I=1,NDV
  450   WRITE(6,455) I
  455   FORMAT(//7X,'ENTER THE GLOBAL NUMBER FOR DESIGN'/
     $  7X,'VARIABLE NUMBER',I3,': ',$)
        READ(5,410,ERR=450) AIDSGN(I)
        IF((AIDSGN(I).LT.1).OR.(AIDSGN(I).GT.999)) GOTO 450
  460   WRITE(6,465)
  465   FORMAT(/7X,'ENTER THE UPPER BOUND ON THIS VARIABLE: ',$)
        READ(5,490,ERR=460) VUB(I)
  490   FORMAT(F10.2)
  491   WRITE(6,492)
  492   FORMAT(7X,'ENTER THE LOWER BOUND ON THIS VARIABLE: ',$)
```

```
      READ(5,490,ERR=491) VLB(I)
      TX(I)=0.5*(ABS(VUB(I)+VLB(I)))
500 CONTINUE
510 STATUS = LIB$SPAWN('CLS')
    WRITE(6,515)
515 FORMAT(/7X,'ENTER THE TOTAL NUMBER OF VARIABLES THAT'/
   &7X,'ARE CONSTRAINED: ',$)
    READ(5,410,ERR=510) NCONS
    DO 600 I=1,NCONS
552   STATUS = LIB$SPAWN('CLS')
      WRITE(6,553) I
553   FORMAT(//7X,'ENTER THE GLOBAL NUMBER FOR CONSTRAINT'/
   &  7X,'VARIABLE',I3,': ',$)
      READ(5,410,ERR=552) ICON(I)
556   WRITE(6,557)
557   FORMAT(/7X,'ENTER THE UPPER BOUND ON THIS CONSTRAINT: ',$)
      READ(5,560,ERR=556) BU(I)
560   FORMAT(F10.2)
564   WRITE(6,565)
565   FORMAT(/7X,'ENTER THE LOWER BOUND ON THIS CONSTRAINT: ',$)
      READ(5,560,ERR=564) BL(I)
600 CONTINUE
    WRITE(7,610) NDV, NDV, IOBJ, SGNOPT
610 FORMAT('$DATA BLOCK B'/'2,'I3,',0,0,0,2,0'/'$DATA BLOCK C'/'1'/
   &'$DATA BLOCK D'/'0.02,,0.04,0.001'//'$DATA BLOCK E'/
   &I3,',',I3,',',F4.1/'$DATA BLOCK F')
    DO 630 I=1,NDV
      WRITE(7,620) VLB(I), VUB(I), TX(I)
620   FORMAT(F10.2,',',F10.2,',',F10.2)
630 CONTINUE
    WRITE(7,640)
640 FORMAT('$DATA BLOCK G')
    DO 650 I=1,NDV
      WRITE(7,645) I, AIDSGN(I)
645   FORMAT(I3,',',I3,',')
650 CONTINUE
    WRITE(7,655) NCONS
655 FORMAT('$ DATA BLOCK H'/I3)
    IF(NCONS.NE.0) THEN     !SKIP DATA BLOCK I IF NO CONSTRAINTS
      WRITE(7,660)
660   FORMAT('$ DATA BLOCK I')
      DO 670 I=1,NCONS
        WRITE(7,665) ICON(I), BL(I), BU(I)
665     FORMAT(I3,',,'/F10.2,',,',F10.2,',')
670   CONTINUE
    ENDIF
    WRITE(7,340)
    GOTO 1000
C ----------------------------------------------------------------------
C --- SENSITIVITY ANALYSIS
C --- NCALC=3, NDV=0, N2VAR=0, NXAPRX=0, IPNPUT=1, IPDBG=0
C --- DATA BLOCKS A, B, P, Q AND V COMPLETED
C ----------------------------------------------------------------------
700 REWIND(7)
    WRITE(6,305)
    READ(5,310) TITLE
    WRITE(7,320) TITLE
710 STATUS = LIB$SPAWN('CLS')
    WRITE(6,715)
715 FORMAT(//7X,'ENTER THE TOTAL NUMBER OF SENSITIVITY'/
```

```
     &7X,'OBJECTIVES (MAX OF EIGHT): ',$)
      READ(5,410,ERR=710) NSOBJ
      IF((NSOBJ.LT.1).OR.(NSOBJ.GT.8)) GOTO 710
      DO 730 I=1,NSOBJ
720     STATUS = LIB$SPAWN('CLS')
        WRITE(6,725) I
725     FORMAT(//7X,'ENTER THE GLOBAL NUMBER FOR SENSITIVITY'/
     &  7X,'OBJECTIVE NUMBER ',I1,': ',$)
        READ(5,410,ERR=760) NSN(I)
        IF((NSN(I).LT.1).OR.(NSN(I).GT.999)) GOTO 760
730   CONTINUE
734   STATUS = LIB$SPAWN('CLS')
      WRITE(6,735)
735   FORMAT(//7X,'ENTER THE TOTAL NUMBER OF SENSITIVITY VARIABLES'
     &/7X,'(A MAXIMUM OF EIGHT): ',$)
      READ(5,410,ERR=734) NSV
      WRITE(7,740) NSV, NSOBJ, (NSN(I),I=1,NSOBJ)
740   FORMAT('$ DATA BLOCK B'/'3,0,',I3,',0,0,2,0'/'$ DATA BLOCK P'/
     &I3,',0'/7(I3,','),I3)
      WRITE(7,741)
741   FORMAT('$ DATA BLOCK Q')
      DO 790 I=1,NSV
750     STATUS = LIB$SPAWN('CLS')
        WRITE(6,755) I
755     FORMAT(//7X,'ENTER THE GLOBAL NUMBER FOR SENSITIVITY'/
     &  7X,'VARIABLE NUMBER ',I1,': ',$)
        READ(5,410,ERR=750) ISENS
760     WRITE(6,765)
765     FORMAT(/7X,'ENTER THE UPPER BOUND ON THIS VARIABLE: ',$)
        READ(5,490,ERR=760) UPPER
770     WRITE(6,775)
775     FORMAT(7X,'ENTER THE LOWER BOUND ON THIS VARIABLE: ',$)
        READ(5,490,ERR=770) LOWER
C ---   THIS NEXT PART WILL SCALE THE SENSITIVITY VARIABLE BETWEEN
C ---   LOWER AND UPPER WITH 7 VALUES TOTAL. THESE 7 VALUES WILL
C ---   BE USED FOR THE SENSITIVITY STUDY
        DIFF=ABS(UPPER-LOWER)/6.0
        SNS(1)=LOWER
        DO 780 J=2,7
          SNS(J)=LOWER+DIFF
          LOWER=LOWER+DIFF
780     CONTINUE
        NSENS=7
        WRITE(7,785) ISENS, NSENS, (SNS(K),K=1,7)
785     FORMAT(I3,',',I3/6(F10.2,','),F10.2)
790   CONTINUE
      WRITE(7,340)
C ----------------------------------------------------------------------
C --- ACSYNT CONTROL SECTION
C --- LINES 1, 2, 3, 4, 5 AND 6 COMPLETED
C ----------------------------------------------------------------------
1000  STATUS = LIB$SPAWN('CLS')
      WRITE(6,1010)
1010  FORMAT(//
     &7X,'ENTER THE AIRCRAFT TYPE THAT MOST CLOSELY RESEMBLES YOUR'
     &/7X,'DESIGN.'//7X,'(1) FIGHTER'/7X,'(2) TRANSPORT'/
     &7X,'(3) BOMBER'//7X,'SELECT 1, 2 OR 3: ',$)
      READ(5,20) ANS
      IF((ANS.NE.'1').AND.(ANS.NE.'2').AND.(ANS.NE.'3')) GOTO 1000
      IF(ANS.EQ.'1') THEN
```

```
        WRITE(7,1020)
 1020   FORMAT('FIGHTER')
        ATYPE='FIGHTER'    ! ATYPE IS PASSED TO WEIGHTS MODULE
      ENDIF
      IF(ANS.EQ.'2') THEN
        WRITE(7,1030)
 1030   FORMAT('TRANSPORT')
        ATYPE='TRANSPORT'
      ENDIF
      IF(ANS.EQ.'3') THEN
        WRITE(7,1040)
 1040   FORMAT('BOMBER')
        ATYPE='BOMBER'
      ENDIF
C --- READ THE OLD VALUES IF DVFLAG.NE..TRUE., THEN RESET THE ACS FILE
C --- POINTER TO THE TOP OF THE ACSYNT CONTROL SECTION
      IF(DVFLAG.EQ..TRUE.) THEN      !SET CONTROL DEFAULTS
        MREAD=5
        MEXEC=3
        MWRITE=5
        IOBJ=570
        JOBJ=585    ! WILL ALWAYS CONVERGE
        IPSUM=1     ! ALWAYS PRINT SUMMARY
        KGLOBP=0
        INIT=0
        IPDBG=2
        IGPLT=1
        IRDDTR=7
        IPDTR=0
        TOL=.0001
        TSLOPE=.75
        WGMAX=50000.0
        NREAD(1)=1
        NREAD(2)=2
        NREAD(3)=3
        NREAD(4)=4
        NREAD(5)=6
        NEXEC(1)=1
        NEXEC(2)=2
        NEXEC(3)=6
        NWRITE(1)=1
        NWRITE(2)=2
        NWRITE(3)=3
        NWRITE(4)=4
        NWRITE(5)=6
        GOTO 2000
      ENDIF
      REWIND(10)
C --- GET THE OLD DATA FROM THE TEMP FILE
 1045 READ(10,210) ANS           ! FIND TOP OF ACSYNT CONTROL SECTION
      IF((ANS.NE.'FIG').AND.(ANS.NE.'TRA').AND.(ANS.NE.'BOM'))
     &GOTO 1045
      READ(10,1060) MREAD, MEXEC, MWRITE, IOBJ, JOBJ, IPSUM, KGLOBP,
     &INIT, IPDBG, IGPLT, IRDDTR, IPDTR
 1060 FORMAT(12I5)
      READ(10,1070) WGMAX
 1070 FORMAT(20X,F10.2)
      READ(10,1080)  (NREAD(I),I=1,MREAD)
 1080 FORMAT(16I5)
      READ(10,1080)  (NEXEC(I),I=1,MEXEC)
```

```
      READ(10,1080) (NWRITE(I),I=1,MWRITE)
C --- GET THE NEW ACSYNT CONTROL DATA OR KEEP THE OLD
C ---   (1)  GEOMETRY
C ---   (2)  TRAJECTORY
C ---   (3)  AERODYNAMICS
C ---   (4)  PROPULSION
C ---   (5)  STABILITY & CONTROL (NOT AVAILABLE YET)
C ---   (6)  WEIGHTS
C ---   (10) NAVY
C ---   (11) SUMMARY  (ALWAYS SELECTED)
C ---   (14) TAKEOFF  (NOT AVAILABLE YET)
C --- MODULES 1, 2, 3, 4 & 6 WILL BE REQUIRED
 2000 DO 2020 I=1,10  !FIND OUT IF MODULES 5, 14 OR 10 ARE CALLED
        IF(NREAD(I).EQ.5)  STFLAG=.TRUE.
        IF(NREAD(I).EQ.14) TOFLAG=.TRUE.
        IF(NREAD(I).EQ.10) NVFLAG=.TRUE.
 2020 CONTINUE
 2030 STATUS = LIB$SPAWN('CLS')
      WRITE(6,2040)
 2040 FORMAT(/
     &7X,'THE FOLLOWING MODULES ARE SELECTED FOR ANALYSIS:'//)
      WRITE(6,2050)
 2050 FORMAT(7X,'(1)  GEOMETRY...............YES')
      WRITE(6,2060)
 2060 FORMAT(7X,'(2)  TRAJECTORY.............YES')
      WRITE(6,2070)
 2070 FORMAT(7X,'(3)  AERODYNAMICS...........YES')
      WRITE(6,2080)
 2080 FORMAT(7X,'(4)  PROPULSION.............YES')
C --- STABILITY AND TAKEOFF COMMENTED OUT UNTIL READY
C     IF(STFLAG.EQ..TRUE.) THEN
C       WRITE(6,2090)
C2090   FORMAT(7X,'(5)  STABILITY & CONTROL....YES')
C     ELSE
C       WRITE(6,2100)
C2100   FORMAT(7X,'(5)  STABILITY & CONTROL....NO')
C     ENDIF
      WRITE(6,2110)
 2110 FORMAT(7X,'(6)  WEIGHTS................YES')
      IF(NVFLAG.EQ..TRUE.) THEN
        WRITE(6,2115)
 2115   FORMAT(7X,'(10) NAVY...................YES')
      ELSE
        WRITE(6,2116)
 2116   FORMAT(7X,'(10) NAVY...................NO')
      ENDIF
C     IF(TOFLAG.EQ..TRUE.) THEN
C       WRITE(6,2120)
C2120   FORMAT(7X,'(14) TAKE-OFF...............YES')
C     ELSE
C       WRITE(6,2130)
C2130   FORMAT(7X,'(14) TAKE-OFF...............NO')
C     ENDIF
      WRITE(6,2140)
 2140 FORMAT(//7X,'ENTER THE MODULE NUMBER TO CHANGE THE STATUS OR'
     &/7X,'ENTER 0 TO CONTINUE: ',$)
      READ(5,2145) ANS
 2145 FORMAT(A2)
C     IF(ANS.EQ.'5') THEN
C       IF(STFLAG.EQ..TRUE.) THEN
```

```
C          STFLAG=.FALSE.
C          GOTO 2030
C        ELSE
C           STFLAG=.TRUE.
C          GOTO 2030
C        ENDIF
C      ENDIF
C      IF(ANS.EQ.'14') THEN
C        IF(TOFLAG.EQ..TRUE.) THEN
C          TOFLAG=.FALSE.
C          GOTO 2030
C        ELSE
C           TOFLAG=.TRUE.
C          GOTO 2030
C        ENDIF
C      ENDIF
       IF(ANS.EQ.'10') THEN
         IF(NVFLAG.EQ..TRUE.) THEN
           NVFLAG=.FALSE.
           GOTO 2030
         ELSE
           NVFLAG=.TRUE.
           GOTO 2030
         ENDIF
       ENDIF
       IF(ANS.NE.'0') GOTO 2030
C --- RESET NREAD ARRAY
       DO 2150 I=1,10
         NREAD(I)=0
 2150  CONTINUE
       NREAD(1)=1
       NREAD(2)=2
       NREAD(3)=3
       NREAD(4)=4
       NREAD(5)=6
       I=6
       IF(STFLAG.EQ..TRUE.) THEN
         NREAD(I)=5
         I=I+1
       ENDIF
       IF(NVFLAG.EQ..TRUE.) THEN
         NREAD(I)=10
         I=I+1
       ENDIF
       IF(TOFLAG.EQ..TRUE.) THEN
         NREAD(I)=14
       ENDIF
       MREAD=0
       DO 2160 I=1,10
         IF(NREAD(I).NE.0) MREAD=MREAD+1
 2160  CONTINUE
       MWRITE=MREAD
C --- RESET NEXEC ARRAY
       DO 2165 I=1,10
         NEXEC(I)=0
 2165  CONTINUE
       NEXEC(1)=1
       NEXEC(2)=2
       NEXEC(3)=6
       I=4
```

```
      IF(STFLAG.EQ..TRUE.) THEN
        NEXEC(I)=-5
        I=I+1
      ENDIF
      IF(NVFLAG.EQ..TRUE.) THEN
        NEXEC(I)=-10
        I=I+1
      ENDIF
      IF(TOFLAG.EQ..TRUE.) THEN
        NEXEC(I)=-14
      ENDIF
      MEXEC=0
      DO 2167 I=1,10
        IF(NEXEC(I).NE.0) MEXEC=MEXEC+1
 2167 CONTINUE
      WRITE(7,1060) MREAD, MEXEC, MWRITE, IOBJ, JOBJ, IPSUM, KGLOBP,
     &INIT, IPDBG, IGPLT, IRDDTR, IPDTR
 2170 STATUS = LIB$SPAWN('CLS')
      WRITE(6,2180) WGMAX
 2180 FORMAT(//
     &7X,'THE MAXIMUM ALLOWABLE TAKE-OFF GROSS WEIGHT IS SET'/
     &7X,'AT ',F10.2,' LBS.'//
     &'       (1) CHANGE WEIGHT'/
     &'       (2) NO CHANGE'//7X,'SELECT 1 OR 2: ',$)
      READ(5,20) ANS
      IF((ANS.NE.'1').AND.(ANS.NE.'2')) GOTO 2170
      IF(ANS.EQ.'1') THEN
 2185   WRITE(6,2190)
 2190   FORMAT(/7X,'ENTER THE MAXIMUM TAKE-OFF GROSS WEIGHT (THIS'/
     &  7X,'WEIGHT IS THE MAXIMUM THAT ACSYNT WILL CONSIDER IF'/
     &  7X,'CONVERGENCE IS NOT POSSIBLE: ',$)
        READ(5,2200,ERR=2185) WGMAX
 2200   FORMAT(F10.2)
        IF((WGMAX.LT.1).OR.(WGMAX.GT.1000000.0)) THEN
        WRITE(6,2205)
 2205   FORMAT(/7X,'* CAUTION: THIS VALUE IS OUTSIDE NORMAL LIMITS')
        ENDIF
        GOTO 2170
      ENDIF
      WRITE(7,1070) WGMAX
      WRITE(7,1080) (NREAD(I),I=1,MREAD)
      WRITE(7,1080) (NEXEC(I),I=1,MEXEC)
      WRITE(7,1080) (NREAD(I),I=1,MREAD)  ! OUTPUT IS SAME AS INPUT
C ---------------------------------------------------------------------
      CALL GEOMETRY(DVFLAG)
C ---------------------------------------------------------------------
      CALL TRAJ(DVFLAG)
C ---------------------------------------------------------------------
      CALL AERO(DVFLAG,NVFLAG)
C ---------------------------------------------------------------------
      CALL PROP(DVFLAG)
C ---------------------------------------------------------------------
      CALL WEIGHTS (DVFLAG, ATYPE)
C ---------------------------------------------------------------------
C     IF(STFLAG.EQ..TRUE.) THEN
C       CALL STABILITY(DVFLAG)
C     ENDIF
C ---------------------------------------------------------------------
      IF(NVFLAG.EQ..TRUE.) THEN
        CALL NAVY
```

```
      ENDIF
C ----------------------------------------------------------------------
C     IF(TOFLAG.EQ..TRUE.) THEN
C       CALL TAKEOFF(DVFLAG)
C     ENDIF
C ----------------------------------------------------------------------
 8400 CLOSE(7)
      CLOSE(10)
      STOP
      END
C    <><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>
      INTEGER FUNCTION GETLEN(STRING)
C --- THIS FUNCTION WILL COUNT THE NUMBER OF RIGHT BLANKS IN "STRING"
C    <><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>
      CHARACTER*6 STRING
      DO 10 I=6,1,-1
        IF(STRING(I:I).NE.' ') THEN
          GETLEN=I
          RETURN
        ENDIF
   10 CONTINUE
      RETURN
      END
C ======================================================================
      SUBROUTINE NAVY
C --- ALL CALCULATIONS SET AT DEFAULTS: TROPICAL DAY
      WRITE(7,10)
   10 FORMAT(' $BOAT  $END')
      RETURN
      END
C ======================================================================
      SUBROUTINE GEOMETRY(DVFLAG)
C ----------------------------------------------------------------------
C --- GEOMETRY SECTION
C ----------------------------------------------------------------------
      CHARACTER WING*3, QWING*3, STRAKE*3, HTAIL*3, VTAIL*3, ANS*6,
     &CANARD*3, WPOD*3, FPOD*3, FUS*3, CREW*3, FUEL*3, TITLE*80
      REAL LFLAPC, LENGTH, LRADAR
      INTEGER STATUS, OUTCOD, SYMCOD, LIB$SPAWN, PODNUM, WPODFL, FPODFL
      LOGICAL DVFLAG, SIZIT, TAND
C --- THE VARIABLES BELOW USED ON GEOMETRY SELECTION MENU
      IF(DVFLAG.EQ..TRUE.) THEN
        WING='YES'     ! WING -OR- QWING REQUIRED
        QWING='NO'
        STRAKE='NO'
        HTAIL='NO'
        VTAIL='NO'
        CANARD='NO'
        WPOD='YES'     ! WPOD -OR- FPOD REQUIRED
        FPOD='NO'
        FUS='YES'
        CREW='NO'
        FUEL='NO'
      ENDIF
      IF(DVFLAG.EQ..TRUE.) GOTO 50     ! OPTION TO BYPASS GEOMETRY
   10 STATUS = LIB$SPAWN('CLS')
      WRITE(6,20)
   20 FORMAT(///
     &7X,'DO YOU WANT TO MAKE ANY CHANGES TO THE GEOMETRY MODULE ?'//
     &7X,'(1) YES'/7X,'(2) NO'//7X,'SELECT 1 OR 2: ',$)
```

```
      READ(5,21,ERR=10) NUM
   21 FORMAT(I1)
      IF((NUM.NE.1).AND.(NUM.NE.2)) GOTO 10
      IF(NUM.EQ.1) GOTO 40
C --- TRANSFER GEOMETRY DATA FROM (10) TO (7)
      REWIND(10)
   25 READ(10,26) ANS
   26 FORMAT(A6)
      IF(ANS.NE.'*** GE') GOTO 25
      WRITE(7,201)
   30 READ(10,31) TITLE
   31 FORMAT(A80)
      WRITE(7,31) TITLE
      IF(TITLE(1:6).NE.'$$$$$$') GOTO 30
      RETURN
C --- DETERMINE OLD GEOMETRY MENU
   40 REWIND (10)
C --- MAKE INITIAL SETTINGS
        WING='NO'
        QWING='NO'
        STRAKE='NO'
        HTAIL='NO'
        VTAIL='NO'
        CANARD='NO'
        WPOD='NO'
        FPOD='NO'
        FUS='YES'
        CREW='NO'
        FUEL='NO'
   42 READ(10,26,END=50) ANS
      IF(ANS.EQ.'$$$$$$') GOTO 50
      IF(ANS.EQ.' $WING') WING='YES'
      IF(ANS.EQ.' $QWIN') QWING='YES'
      IF(ANS.EQ.' $STRA') STRAKE='YES'
      IF(ANS.EQ.' $HTAI') HTAIL='YES'
      IF(ANS.EQ.' $VTAI') VTAIL='YES'
      IF(ANS.EQ.' $CANA') CANARD='YES'
      IF(ANS.EQ.' $WPOD') WPOD='YES'
      IF(ANS.EQ.' $FPOD') FPOD='YES'
      IF(ANS.EQ.' $FUS ') FUS='YES'
      IF(ANS.EQ.' $CREW') CREW='YES'
      IF(ANS.EQ.' $FUEL') FUEL='YES'
      GOTO 42
C -----------------------------------------------------------------------
C --- GEOMETRY SELECTION MENU
C -----------------------------------------------------------------------
   50 STATUS = LIB$SPAWN('CLS')
   60 WRITE(6,61) WING, QWING, STRAKE, HTAIL, VTAIL, CANARD, WPOD,
     &FPOD, FUS, CREW, FUEL
   61 FORMAT(/
     &7X,'** GEOMETRY SELECTION MENU **'//
     &7X,'(1)  SYMMETRIC WING....................',A3/
     &7X,'(2)  OBLIQUE WING......................',A3/
     &7X,'(3)  LE OR TE STRAKES..................',A3/
     &7X,'(4)  HORIZONTAL TAIL...................',A3/
     &7X,'(5)  VERTICAL TAIL.....................',A3/
     &7X,'(6)  CANARD............................',A3/
     &7X,'(7)  WING MOUNTED ENGINE PODS..........',A3/
     &7X,'(8)  FUSELAGE MOUNTED ENGINE PODS......',A3/
     &7X,'(9)  FUSELAGE (REQUIRED)...............',A3/
```

```
     &7X,'(10) CREW COCKPIT.....................',A3/
     &7X,'(11) FUSELAGE FUEL BAYS...............',A3//
     &7X,'SELECT AN ITEM TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,65,ERR=50) NUM
   65 FORMAT(I2)
      IF(NUM.EQ.0) GOTO 200
      GOTO (80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180), NUM
      GOTO 50
   80 IF(WING.EQ.'YES') THEN
        WING='NO'
        QWING='YES'
      ELSE
        WING='YES'
        QWING='NO'
      ENDIF
      GOTO 50
   90 IF(QWING.EQ.'YES') THEN
        QWING='NO'
        WING='YES'
      ELSE
        QWING='YES'
        WING='NO'
      ENDIF
      GOTO 50
  100 IF(STRAKE.EQ.'YES') THEN
        STRAKE='NO'
      ELSE
        STRAKE='YES'
      ENDIF
      GOTO 50
  110 IF(HTAIL.EQ.'YES') THEN
        HTAIL='NO'
      ELSE
        HTAIL='YES'
      ENDIF
      GOTO 50
  120 IF(VTAIL.EQ.'YES') THEN
        VTAIL='NO'
      ELSE
        VTAIL='YES'
      ENDIF
      GOTO 50
  130 IF(CANARD.EQ.'YES') THEN
        CANARD='NO'
      ELSE
        CANARD='YES'
      ENDIF
      GOTO 50
  140 IF(WPOD.EQ.'YES') THEN
        WPOD='NO'
        FPOD='YES'
      ELSE
        WPOD='YES'
        FPOD='NO'
      ENDIF
      GOTO 50
  150 IF(FPOD.EQ.'YES') THEN
        FPOD='NO'
        WPOD='YES'
      ELSE
```

```
           FPOD='YES'
           WPOD='NO'
        ENDIF
        GOTO 50
  160   IF(FUS.EQ.'YES') THEN
           FUS='YES'
        ELSE
           FUS='YES'
        ENDIF
        GOTO 50
  170   IF(CREW.EQ.'YES') THEN
           CREW='NO'
        ELSE
           CREW='YES'
        ENDIF
        GOTO 50
  180   IF(FUEL.EQ.'YES') THEN
           FUEL='NO'
        ELSE
           FUEL='YES'
        ENDIF
        GOTO 50
  200   WRITE(7,201)      !WRITE THE GEOMETRY HEADER TO UNIT 7
  201   FORMAT('*** GEOMETRY DATA ***')
C ---   THE $WING AND $QWING DEFAULTS ARE QUITE SIMILAR SO ONLY THE $WING
C ---   DEFAULTS WILL BE SET, SINCE THESE ALSO COVER THE $QWING VALUES
        IF(DVFLAG.EQ..TRUE.) THEN
           CALL WINGDV(AR,AREA,DIHED,FDENWG,LFLAPC,SWEEP,SWFACT,TAPER,
     &     TCROOT,TCTIP,TFLAPC,WFFRAC,XWING,ZROOT,KSWEEP,OUTCOD)
           GOTO 2400
        ENDIF
C ---   GET OLD VALUES. CHECK TO SEE IF THE OLD VALUES ACTUALLY EXIST
        IF(WING.EQ.'YES') THEN   ! GET $WING VALUES
           REWIND(10)
  220      READ(10,26) ANS
           IF(ANS.EQ.'$$$$$$') THEN !OLD $WING NOT FOUND. SET DEFAULTS
              CALL WINGDV(AR,AREA,DIHED,FDENWG,LFLAPC,SWEEP,SWFACT,TAPER,
     &        TCROOT,TCTIP,TFLAPC,WFFRAC,XWING,ZROOT,KSWEEP,OUTCOD)
              GOTO 2400
           ENDIF
           IF(ANS.NE.' $WING') GOTO 220
           READ(10,2340) AR, AREA, DIHED, FDENWG, LFLAPC,SWEEP, SWFACT,
     &     TAPER, TCROOT, TCTIP, TFLAPC, WFFRAC, XWING, ZROOT, KSWEEP,
     &     OUTCOD
 2340      FORMAT(8X,F5.2,12X,F7.2,9X,F5.2/12X,F6.2,9X,F4.2,10X,F6.2
     &     /12X,F4.2,10X,F4.2,12X,F4.2/11X,F4.2,12X,F4.2,11X,F4.2
     &     /11X,F4.2,11X,F5.2,11X,I1/12X,I1)
        ELSE   ! GET $QWING VALUES
           REWIND(10)
 2350      READ(10,26) ANS
           IF(ANS.EQ.'$$$$$$') THEN   ! OLD $QWING NOT FOUND. SET DEFAULTS
              CALL WINGDV(AR,AREA,DIHED,FDENWG,LFLAPC,SWEEP,SWFACT,TAPER,
     &        TCROOT,TCTIP,TFLAPC,WFFRAC,XWING,ZROOT,KSWEEP,OUTCOD)
              GOTO 2400
           ENDIF
           IF(ANS.NE.' $QWIN') GOTO 2350
           READ(10,2360) AR, AREA, DIHED, LFLAPC, SWFACT, TAPER, TCROOT,
     &     TCTIP, TFLAPC, XWING, ZROOT, WFFRAC, FDENWG, OUTCOD
 2360      FORMAT(8X,F5.2,12X,F7.2,9X,F5.2/12X,F4.2,11X,F4.2,10X,F4.2/
     &     12X,F4.2,10X,F4.2,12X,F4.2/11X,F4.2,11X,F5.2,11X,F4.2/
```

```
     &  12X,F6.2,9X,I1)
        ENDIF
 2400 IF(WING.EQ.'YES') THEN   ! $WING GEOMETRY CHANGE MENU
C -----------------------------------------------------------------------
C --- SET UP $WING NAMELIST
C -----------------------------------------------------------------------
 2405   STATUS = LIB$SPAWN('CLS')
        WRITE(6,2410) AR, AREA, DIHED, FDENWG, LFLAPC, SWEEP, SWFACT,
     &  TAPER, TCROOT, TCTIP, TFLAPC, WFFRAC, XWING, ZROOT
 2410   FORMAT(/
     &  7X,'** SYMMETRIC WING GEOMETRY **'//
     &  7X,'(1)  ASPECT RATIO.............................',F5.2/
     &  7X,'(2)  AREA (SQ FT)............................',F7.2/
     &  7X,'(3)  DIHEDRAL (DEG)...........................',F5.2/
     &  7X,'(4)  FUEL DENSITY (LB/FT3)....................',F6.2/
     &  7X,'(5)  L.E. FLAP WIDTH (%CHORD)...................',F4.2/
     &  7X,'(6)  L.E. SWEEP (DEG)..........................',F6.2/
     &  7X,'(7)  WETTED AREA MULTIPLIER......................',F4.2/
     &  7X,'(8)  TAPER RATIO...............................',F4.2/
     &  7X,'(9)  T/C RATIO, WING ROOT........................',F4.2/
     &  7X,'(10) T/C RATIO, WING TIP.........................',F4.2/
     &  7X,'(11) T.E. FLAP WIDTH (%CHORD)...................',F4.2/
     &  7X,'(12) FRACTION OF WING VOLUME THAT'/
     &  7X,'     WILL BE FILLED WITH FUEL..................',F4.2/
     &  7X,'(13) POSITION OF WING 1/4 CHORD (%BODY LENGTH)..',F4.2/
     &  7X,'(14) ELEVATION OF WING ON FUSELAGE.............',F5.2/
     &  7X,'      (1.0=TOP, 0.0=MID-MOUNT, -1.0=BOTTOM)'//
     &  7X,'SELECT THE VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
        READ(5,2411,ERR=2405) NUM
 2411   FORMAT(I2)
        IF(NUM.EQ.0) GOTO 2580
        GOTO (2425, 2440, 2450, 2465, 2480, 2495, 2500, 2510, 2520,
     &  2530, 2540, 2550, 2560, 2570) ,NUM
        GOTO 2405
 2425   WRITE(6,2430)
 2430   FORMAT(/7X,'ENTER THE ASPECT RATIO: ',$)
        READ(5,2460,ERR=2425) AR
        IF((AR.LE.0.0).OR.(AR.GT.12.0)) GOTO 2425
        GOTO 2405
 2440   WRITE(6,2445)
 2445   FORMAT(/7X,'ENTER THE WING AREA (SQ FT): ',$)
        READ(5,2446,ERR=2440) AREA
 2446   FORMAT(F7.2)
        IF(AREA.LE.0) GOTO 2440
        GOTO 2405
 2450   WRITE(6,2455)
 2455   FORMAT(/7X,'ENTER THE WING DIHEDRAL (DEG): ',$)
        READ(5,2460,ERR=2450) DIHED
 2460   FORMAT(F5.2)
        IF((DIHED.LT.-20.0).OR.(DIHED.GT.20.0)) GOTO 2450
        GOTO 2405
 2465   WRITE(6,2470)
 2470   FORMAT(/7X,'ENTER THE FUEL DENSITY (LB/FT3): ',$)
        READ(5,2475,ERR=2465) FDENWG
 2475   FORMAT(F6.2)
        IF((FDENWG.LE.0.0)) GOTO 2465
        GOTO 2405
 2480   WRITE(6,2485)
 2485   FORMAT(/7X,'ENTER THE LEADING EDGE FLAP WIDTH'/
     &  7X,'IN PERCENT OF TOTAL CHORD: ',$)
```

```
      READ(5,2490,ERR=2480) LFLAPC
2490  FORMAT(F4.2)
      IF((LFLAPC.LT.0.0).OR.(LFLAPC.GT.0.5)) GOTO 2480
      GOTO 2405
2495  WRITE(6,2496)
2496  FORMAT(/7X,'ENTER THE LE WING SWEEP (DEG): ',$)
      READ(5,2475,ERR=2495) SWEEP
      IF((SWEEP.LT.-30.0).OR.(SWEEP.GT.60.0)) GOTO 2495
      GOTO 2405
2500  WRITE(6,2505)
2505  FORMAT(/7X,'ENTER THE WETTED AREA MULTIPLIER: ',$)
      READ(5,2490,ERR=2500) SWFACT
      IF((SWFACT.LE.0.0).OR.(SWFACT.GT.2.0)) GOTO 2500
      GOTO 2405
2510  WRITE(6,2515)
2515  FORMAT(/7X,'ENTER THE TAPER RATIO: ',$)
      READ(5,2490,ERR=2510) TAPER
      IF((TAPER.LT.0.0).OR.(TAPER.GT.1.0)) GOTO 2510
      GOTO 2405
2520  WRITE(6,2525)
2525  FORMAT(/7X,'ENTER THE THICKNESS TO CHORD RATIO'/
    & 7X,'AT THE WING ROOT: ',$)
      READ(5,2490,ERR=2520) TCROOT
      IF((TCROOT.LT.0.02).OR.(TCROOT.GT.0.18)) GOTO 2520
      GOTO 2405
2530  WRITE(6,2535)
2535  FORMAT(/7X,'ENTER THE THICKNESS TO CHORD RATIO'/
    & 7X,'AT THE WING TIP: ',$)
      READ(5,2490,ERR=2530) TCTIP
      IF((TCTIP.LT.0.02).OR.(TCTIP.GT.0.18)) GOTO 2530
      GOTO 2405
2540  WRITE(6,2545)
2545  FORMAT(/7X,'ENTER THE TE FLAP WIDTH AS'/
    & 7X,'PERCENT OF TOTAL WING CHORD: ',$)
      READ(5,2490,ERR=2540) TFLAPC
      IF((TFLAPC.LT.0.0).OR.(TFLAPC.GT.0.5)) GOTO 2540
      GOTO 2405
2550  WRITE(6,2555)
2555  FORMAT(/7X,'ENTER THE AMOUNT OF WING VOLUME THAT WILL'/
    & 7X,'BE FILLED WITH FUEL, AS PERCENT OF WING VOLUME: ',$)
      READ(5,2490,ERR=2550) WFFRAC
      IF((WFFRAC.GT.1.0).OR.(WFFRAC.LT.0.0)) GOTO 2550
      GOTO 2405
2560  WRITE(6,2565)
2565  FORMAT(/7X,'ENTER THE POSITION OF THE WING QUARTER CHORD'/
    & 7X,'AS A FRACTION OF BODY LENGTH: ',$)
      READ(5,2490,ERR=2560) XWING
      IF((XWING.GT.1.0).OR.(XWING.LT.0.0)) GOTO 2560
      GOTO 2405
2570  WRITE(6,2575)
2575  FORMAT(/7X,'ENTER THE ELEVATION OF THE WING ON THE FUSELAGE'/
    & 7X,'(1.0=TOP, 0.0=MID-MOUNT, -1.0=BOTTOM): ',$)
      READ(5,2460,ERR=2570) ZROOT
      IF((ZROOT.GT.1.0).OR.(ZROOT.LT.-1.0)) GOTO 2570
      GOTO 2405
2580  WRITE(7,2600) AR, AREA, DIHED, FDENWG, LFLAPC,SWEEP, SWFACT,
    & TAPER, TCROOT, TCTIP, TFLAPC, WFFRAC, XWING, ZROOT, KSWEEP,
    & OUTCOD
2600  FORMAT(' $WING'/
    & 5X,'AR=',F5.2,',',6X,'AREA=',F7.2,',',2X 'DIHED=',F5.2,
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     & ','/5X,'FDENWG=',F6.2,',',1X,'LFLAPC=',F4.2,',',3X,'SWEEP=',F6.2
     & ,',','/5X,'SWFACT=',F4.2,',',3X,'TAPER=',F4.2,',',4X,'TCROOT=',
     & F4.2,',','/5X,'TCTIP=',F4.2,',',4X,'TFLAPC=',F4.2,',',3X,'WFFRAC='
     & ,F4.2,',','/5X,'XWING=',F4.2,',',4X,'ZROOT=',F5.2,',',3X,'KSWEEP='
     & ,I1,',','/5X,'OUTCOD=',I1,',','/5X,'$END')
       GOTO 2800
      ELSE         ! $QWING GEOMETRY CHANGE MENU
C --------------------------------------------------------------------
C --- SET UP $QWING NAMELIST
C --------------------------------------------------------------------
 2610  STATUS = LIB$SPAWN('CLS')
       WRITE(6,2615) AR, AREA, DIHED, LFLAPC, SWFACT, TAPER, TCROOT,
     & TCTIP, TFLAPC, XWING, ZROOT, WFFRAC, FDENWG
 2615  FORMAT(/
     & 7X,'** OBLIQUE WING GEOMETRY **'//
     & 7X,'(1)  ASPECT RATIO..........................',F5.2/
     & 7X,'(2)  AREA (SQ FT)........................',F7.2/
     & 7X,'(3)  DIHEDRAL (DEG)........................',F5.2/
     & 7X,'(4)  LE FLAP WIDTH (FRACTION TOTAL CHORD)....',F4.2/
     & 7X,'(5)  WETTED AREA MULTIPLIER..................',F4.2/
     & 7X,'(6)  TAPER RATIO.............................',F4.2/
     & 7X,'(7)  T/C RATIO, WING ROOT....................',F4.2/
     & 7X,'(8)  T/C RATIO, WING TIP.....................',F4.2/
     & 7X,'(9)  TE FLAP WIDTH (FRACTION TOTAL CHORD)....',F4.2/
     & 7X,'(10) POSITION OF WING 1/4 CHORD, AS A '/
     & 7X,'     FRACTION OF TOTAL FUSELAGE LENGTH.......',F4.2/
     & 7X,'(11) ELEVATION OF WING ON THE FUSELAGE......',F5.2/
     & 7X,'      (1.0=TOP, 0.0=MID-MOUNT, -1.0=BOTTOM)'/
     & 7X,'(12) FRACTION OF WING VOLUME THAT WILL'/
     & 7X,'     BE FILLED WITH FUEL....................',F4.2/
     & 7X,'(13) FUEL DENSITY (LB/FT3).................',F6.2//
     & 7X,'SELECT THE VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
       READ(5,2411,ERR=2610) NUM
       IF(NUM.EQ.0) GOTO 2760
       GOTO (2629, 2635, 2645, 2655, 2665, 2675, 2685, 2695, 2705,
     & 2715, 2725, 2735, 2745) ,NUM
       GOTO 2610
 2629  WRITE(6,2630)
 2630  FORMAT(/7X,'ENTER THE ASPECT RATIO: ',$)
       READ(5,2460,ERR=2629) AR
       IF((AR.LE.0.0).OR.(AR.GT.12.0)) GOTO 2629
       GOTO 2610
 2635  WRITE(6,2640)
 2640  FORMAT(/7X,'ENTER THE WING AREA (SQ FT): ',$)
       READ(5,2446,ERR=2635) AREA
       IF(AREA.LE.0.0) GOTO 2635
       GOTO 2610
 2645  WRITE(6,2650)
 2650  FORMAT(/7X,'ENTER THE WING DIHEDRAL (DEG): ',$)
       READ(5,2460,ERR=2645) DIHED
       IF((DIHED.LT.-20.0).OR.(DIHED.GT.20.0)) GOTO 2645
       GOTO 2610
 2655  WRITE(6,2660)
 2660  FORMAT(/7X,'ENTER THE LE FLAP WIDTH AS A'/
     & '        FRACTION OF THE TOTAL CHORD: ',$)
       READ(5,2490,ERR=2655) LFLAPC
       IF((LFLAPC.LT.0.0).OR.(LFLAPC.GT.0.5)) GOTO 2655
       GOTO 2610
 2665  WRITE(6,2670)
 2670  FORMAT(/7X,'ENTER THE WETTED AREA MULTIPLIER: ',$)
```

```
         READ(5,2490,ERR=2665) SWFACT
         IF((SWFACT.LT.0.0).OR.(SWFACT.GT.2.0)) GOTO 2665
         GOTO 2610
2675     WRITE(6,2680)
2680     FORMAT(/7X,'ENTER THE TAPER RATIO: ',$)
         READ(5,2490,ERR=2675) TAPER
         IF((TAPER.LT.0.0).OR.(TAPER.GT.1.0)) GOTO 2675
         GOTO 2610
2685     WRITE(6,2690)
2690     FORMAT(/7X,'ENTER THE T/C RATIO AT THE ROOT: ',$)
         READ(5,2490,ERR=2685) TCROOT
         IF((TCROOT.LE.0.02).OR.(TCROOT.GT.0.18)) GOTO 2685
         GOTO 2610
2695     WRITE(6,2700)
2700     FORMAT(/7X,'ENTER THE T/C RATIO AT THE WING TIP: ',$)
         READ(5,2490,ERR=2695) TCTIP
         IF((TCTIP.LE.0.02).OR.(TCTIP.GT.0.18)) GOTO 2695
         GOTO 2610
2705     WRITE(6,2710)
2710     FORMAT(/7X,'ENTER THE TE FLAP WIDTH AS A FRACTION'/
     &   '        OF TOTAL CHORD: ',$)
         READ(5,2490,ERR=2705) TFLAPC
         IF((TFLAPC.LT.0.0).OR.(TFLAPC.GT.0.5)) GOTO 2705
         GOTO 2610
2715     WRITE(6,2720)
2720     FORMAT(/7X,'ENTER THE POSITION OF THE WING 1/4 CHORD'/
     &   '        AS A FRACTION OF TOTAL BODY LENGTH: ',$)
         READ(5,2490,ERR=2715) XWING
         IF((XWING.GT.1.0).OR.(XWING.LT.0.0)) GOTO 2715
         GOTO 2610
2725     WRITE(6,2730)
2730     FORMAT(/7X,'ENTER THE ELEVATION OF THE WING ON THE'/
     &   '        FUSELAGE (1.0=TOP, 0.0=MID-MOUNT, -1.0=BOTTOM): ',$)
         READ(5,2460,ERR=2725) ZROOT
         IF((ZROOT.LT.-1.0).OR.(ZROOT.GT.1.0)) GOTO 2725
         GOTO 2610
2735     WRITE(6,2740)
2740     FORMAT(/7X,'ENTER THE FRACTION OF THE WING VOLUME THAT'/
     &   7X,'WILL BE FILLED WITH FUEL: ',$)
         READ(5,2490,ERR=2735) WFFRAC
         IF((WFFRAC.GT.1.0).OR.(WFFRAC.LT.0.0)) GOTO 2735
         GOTO 2610
2745     WRITE(6,2750)
2750     FORMAT(/7X,'ENTER THE FUEL DENSITY (LB/FT3): ',$)
         READ(5,2475,ERR=2745) FDENWG
         IF((FDENWG.LT.0.0)) GOTO 2745
         GOTO 2610
2760     WRITE(7,2765) AR, AREA, DIHED, LFLAPC, SWFACT, TAPER, TCROOT,
     &   TCTIP, TFLAPC, XWING, ZROOT, WFFRAC, FDENWG, OUTCOD
2765     FORMAT(' $QWING'/
     &   5X,'AR=',F5.2,',',6X,'AREA=',F7.2,',',2X,'DIHED=',F5.2,',',/
     &   5X,'LFLAPC=',F4.2,',',3X,'SWFACT=',F4.2,',',3X,'TAPER=',F4.2,
     &   ','/5X,'TCROOT=',F4.2,',',3X,'TCTIP=',F4.2,',',4X,'TFLAPC=',
     &   F4.2,','/5X,'XWING=',F4.2,',',4X,'ZROOT=',F5.2,',',3X,
     &   'WFFRAC=',F4.2,','/5X,'FDENWG=',F6.2,',',1X,'OUTCOD=',I1,','/
     &   5X,'$END')
         GOTO 2800
      ENDIF
C -----------------------------------------------------------------
C --- STRAKE GEOMETRY
```

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C ----------------------------------------------------------------
 2800 IF(STRAKE.EQ.'NO') GOTO 3000
      IF(DVFLAG.EQ..TRUE.) THEN  ! SET STRAKE DEFAULTS
        XLEXT=0.0
        YSEXT=0.0
        XLAFT=0.0
        YSAFT=0.0
        SWFACT=1.0
        IFLEX=0
      ELSE         ! GET THE OLD STRAKE VALUES
        REWIND(10)
 2830   READ(10,26) ANS
        IF(ANS.EQ.'$$$$$$') THEN    ! OLD STRAKE NOT FOUND
          XLEXT=0.0
          YSEXT=0.0
          XLAFT=0.0
          YSAFT=0.0
          SWFACT=1.0
          IFLEX=0
        ELSE       ! OLD STRAKE VALUES FOUND
          IF(ANS.NE.' $STRA') GOTO 2830
          READ(10,2840) XLEXT, YSEXT, XLAFT, YSAFT, SWFACT,
     &    IFLEX
 2840     FORMAT(11X,F4.2,11X,F4.2,11X,F4.2/11X,F4.2,
     &    12X,F4.2,10X,I1)
        ENDIF
      ENDIF
 2850 STATUS = LIB$SPAWN('CLS')
      WRITE(6,2860) XLEXT, YSEXT, XLAFT, YSAFT, SWFACT, IFLEX
 2860 FORMAT(/
     &7X,'** STRAKE GEOMETRY **'//
     &7X,'(1) X LOCATION OF THE LE STRAKE AS A'/
     &7X,'    FRACTION OF TOTAL FUSELAGE LENGTH.........',F4.2/
     &7X,'(2) RATIO OF THE LE STRAKE SPAN/2 TO THE'/
     &7X,'    WING SPAN/2..............................',F4.2/
     &7X,'(3) X LOCATION OF THE TE STRAKE AS A'/
     &7X,'    FRACTION OF TOTAL FUSELAGE LENGTH.........',F4.2/
     &7X,'(4) RATIO OF THE TE STRAKE SPAN/2 TO THE'/
     &7X,'    WING SPAN/2..............................',F4.2/
     &7X,'(5) WETTED AREA MULTIPLIER FOR BOTH STRAKES...',F4.2/
     &7X,'(6) STRAKE BLUNTNESS FLAG.....................',I1/
     &7X,'     (SHARP LEADING EDGE=0)'/
     &7X,'     (BLUNT LEADING EDGE=1)'//
     &7X,'SELECT THE VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,21,ERR=2850) NUM
      IF(NUM.EQ.0) GOTO 2950
      GOTO (2880, 2890, 2900, 2910, 2920, 2930), NUM
      GOTO 2850
 2880 WRITE(6,2881)
 2881 FORMAT(/7X,'ENTER THE X LOCATION OF THE LE STRAKE AS'/
     &'         A FRACTION OF TOTAL FUSELAGE LENGTH: ',$)
      READ(5,2490,ERR=2880) XLEXT
      IF((XLEXT.LT.0.0).OR.(XLEXT.GT.XWING)) GOTO 2880
      GOTO 2850
 2890 WRITE(6,2891)
 2891 FORMAT(/7X,'ENTER THE RATIO OF THE LE STRAKE SPAN/2'/
     &7X,'TO THE WING SPAN/2: ',$)
      READ(5,2490,ERR=2890) YSEXT
      IF((YSEXT.GT.1.0).OR.(YSEXT.LT.0.0)) GOTO 2890
      GOTO 2850
```

```
 2900 WRITE(6,2901)
 2901 FORMAT(/7X,'ENTER THE X LOCATION OF THE TE STRAKE AS'/
     &7X,'A FRACTION OF TOTAL FUSELAGE LENGTH: ',$)
      READ(5,2490,ERR=2900) XLAFT
      IF((XLAFT.LT.XWING).OR.(XLAFT.GT.1.0)) GOTO 2900
      GOTO 2850
 2910 WRITE(6,2911)
 2911 FORMAT(/7X,'ENTER THE RATIO OF THE TE STRAKE SPAN/2'/
     &7X,'TO THE WING SPAN/2: ',$)
      READ(5,2490,ERR=2910) YSAFT
      IF((YSAFT.GT.1.0).OR.(YSAFT.LT.0.0)) GOTO 2910
      GOTO 2850
 2920 WRITE(6,2921)
 2921 FORMAT(/7X,'ENTER THE WETTED AREA MULTIPLIER: ',$)
      READ(5,2490,ERR=2920) SWFACT
      IF((SWFACT.LT.0.0).OR.(SWFACT.GT.2.0)) GOTO 2920
      GOTO 2850
 2930 WRITE(6,2931)
 2931 FORMAT(/7X,'ENTER THE STRAKE BLUNTNESS FLAG'/
     &7X,'(SHARP LE=0, BLUNT LE=1): ',$)
      READ(5,2940,ERR=2930) IFLEX
 2940 FORMAT(I1)
      IF((IFLEX.NE.0).AND.(IFLEX.NE.1)) GOTO 2930
      GOTO 2850
 2950 WRITE(7,2951) XLEXT, YSEXT, XLAFT, YSAFT, SWFACT, IFLEX
 2951 FORMAT(' $STRAKE'/5X,'XLEXT=',F4.2,',',4X,'YSEXT=',F4.2,
     &',',4X,'XLAFT=',F4.2,','/5X,'YSAFT=',F4.2,',',4X,
     &'SWFACT=',F4.2,',',3X,'IFLEX=',I1,','/5X,'$END')
      GOTO 3000
C ----------------------------------------------------------------------
C --- HORIZONTAL TAIL GEOMETRY
C ----------------------------------------------------------------------
 3000 IF(HTAIL.EQ.'NO') GOTO 3200
      IF(DVFLAG.EQ..TRUE.) THEN      ! SET DEFAULTS
        AR=5.0
        AREA=50.0
        CVHT=1.0
        HTFRAC=0.0
        SWEEP=0.0
        SWFACT=1.0
        TAPER=0.99
        TCROOT=0.1
        TCTIP=0.1
        XHTAIL=1.0
        ZROOT=0.0
        KSWEEP=0
        OUTCOD=2
        SIZIT=.FALSE.
      ELSE
        REWIND(10)
 3010   READ(10,26) ANS
        IF(ANS.EQ.'$$$$$$') THEN
          AR=5.0
          AREA=0.0
          CVHT=1.0
          HTFRAC=0.0
          SWEEP=0.0
          SWFACT=1.0
          TAPER=0.99
          TCROOT=0.1
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        TCTIP=0.1
        XHTAIL=1.0
        ZROOT=0.0
        KSWEEP=0
        OUTCOD=2
        SIZIT=F
      ELSE
        IF(ANS.NE.' $HTAI') GOTO 3010
        READ(10,3020) AR, AREA, CVHT, HTFRAC, SWEEP, SWFACT, TAPER,
     &  TCROOT, TCTIP, XHTAIL, ZROOT, KSWEEP, OUTCOD, SIZIT
3020    FORMAT(8X,F5.2,12X,F7.2,8X,F4.2/12X,F5.3,9X,F5.2,11X,F4.2/
     &  11X,F4.2,12X,F4.2,10X,F4.2/12X,F4.2,10X,F4.2,12X,I1/
     &  12X,I1,13X,L1)
      ENDIF
    ENDIF
3030 STATUS = LIB$SPAWN('CLS')
    WRITE(6,3040) AR, AREA, CVHT, SWEEP, SWFACT, TAPER,
   &TCROOT, TCTIP, XHTAIL, ZROOT, SIZIT, HTFRAC
3040 FORMAT(/
   &7X,'** HORIZONTAL TAIL GEOMETRY **'//
   &7X,'(1)  ASPECT RATIO..............................',F5.2/
   &7X,'(2)  SURFACE AREA (SQ FT).....................',F7.2/
   &7X,'(3)  TAIL VOLUME COEFFICIENT....................',F4.2/
   &7X,'(4)  LE SWEEP (DEG)............................',F5.2/
   &7X,'(5)  WETTED AREA MULTIPLIER.....................',F4.2/
   &7X,'(6)  TAPER RATIO...............................',F4.2/
   &7X,'(7)  T/C RATIO AT ROOT.........................',F4.2/
   &7X,'(8)  T/C RATIO AT TIP..........................',F4.2/
   &7X,'(9)  POSITION OF THE TE OF TAIL ROOT CHORD AS'/
   &7X,'     A FRACTION OF TOTAL FUSELAGE LENGTH........',F4.2/
   &7X,'(10) ELEVATION OF TAIL ON FUSELAGE..............',F4.2/
   &7X,'      (0 - 1.0: TAIL WITHIN FUSELAGE)'/
   &7X,'      (1.0 - 1.99: TAIL ABOVE FUSELAGE)'/
   &7X,'      (2.0: HORIZONTAL TAIL ON TOP OF VERTICAL TAIL)'/
   &7X,'(11) SIZING LOGIC..............................',L1/
   &7X,'      (T = TAIL AREA RECOMPUTED BY ACSYNT)'/
   &7X,'      (F = USE THE INPUT TAIL AREA ONLY)'/
   &7X,'(12) HORIZONTAL TAIL SIZING FRACTION............',F5.3//
   &7X,'SELECT A VALUE TO CHANGE OR 0 TO QUIT: ',$)
    READ(5,2411,ERR=3030) NUM
    IF(NUM.EQ.0) GOTO 3120
    GOTO (3050, 3055, 3060, 3065, 3070, 3075, 3080, 3085, 3090,
   &3095, 3100, 3110), NUM
    GOTO 3030
3050 WRITE(6,3051)
3051 FORMAT(/7X,'ENTER THE ASPECT RATIO: ',$)
    READ(5,2460,ERR=3050) AR
    IF((AR.LT.0.0).OR.(AR.GT.12.0)) GOTO 3050
    GOTO 3030
3055 WRITE(6,3056)
3056 FORMAT(/7X,'ENTER THE HORIZONTAL TAIL AREA (SQ FT): ',$)
    READ(5,2446,ERR=3055) AREA
    IF(AREA.LT.0.0) GOTO 3055
    GOTO 3030
3060 WRITE(6,3061)
3061 FORMAT(/7X,'ENTER THE TAIL VOLUME COEFFICIENT: ',$)
    READ(5,2490,ERR=3060) CVHT
    IF((CVHT.LT.0.3).OR.(CVHT.GT.1.0)) GOTO 3060
    GOTO 3030
3065 WRITE(6,3066)
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3066 FORMAT(/7X,'ENTER THE LEADING EDGE TAIL SWEEP (DEG): ',$)
     READ(5,2460,ERR=3065) SWEEP
     IF((SWEEP.LT.-9.0).OR.(SWEEP.GT.60.0)) GOTO 3065
     GOTO 3030
3070 WRITE(6,3071)
3071 FORMAT(/7X,'ENTER THE WETTED AREA MULTIPLIER: ',$)
     READ(5,2490,ERR=3070) SWFACT
     IF((SWFACT.LT.0.0).OR.(SWFACT.GT.2.0)) GOTO 3070
     GOTO 3030
3075 WRITE(6,3076)
3076 FORMAT(/7X,'ENTER THE HORIZONTAL TAIL TAPER RATIO: ',$)
     READ(5,2490,ERR=3075) TAPER
     IF((TAPER.LT.0.0).OR.(TAPER.GT.1.0)) GOTO 3075
     GOTO 3030
3080 WRITE(6,3081)
3081 FORMAT(/7X,'ENTER THE THICKNESS/CHORD RATIO'/
    &7X,'AT THE HORIZONTAL TAIL ROOT: ',$)
     READ(5,2490,ERR=3080) TCROOT
     IF((TCROOT.LT.0.02).OR.(TCROOT.GT.0.18)) GOTO 3080
     GOTO 3030
3085 WRITE(6,3086)
3086 FORMAT(/7X,'ENTER THE THICKNESS/CHORD RATIO AT THE TAIL TIP: ',$)
     READ(5,2490,ERR=3085) TCTIP
     IF((TCTIP.LT.0.02).OR.(TCTIP.GT.0.18)) GOTO 3085
     GOTO 3030
3090 WRITE(6,3091)
3091 FORMAT(/7X,'ENTER THE POSITION OF THE TRAILING EDGE'/
    &7X,'OF THE HORIZONTAL TAIL AS A FRACTION OF TOTAL'/
    &7X,'FUSELAGE LENGTH: ',$)
     READ(5,2490,ERR=3090) XHTAIL
     IF((XHTAIL.LT.0.5).OR.(XHTAIL.GT.1.0)) GOTO 3090
     GOTO 3030
3095 WRITE(6,3096)
3096 FORMAT(/7X,'ENTER THE ELEVATION OF THE HORIZONTAL TAIL'/
    &7X,'0.0 - 0.99 HAS THE TAIL IN THE FUSELAGE'/
    &7X,'1.0 - 1.99 HAS THE TAIL ON THE VERTICAL STAB'/
    &7X,'2.0 HAS THE TAIL ON TOP OF THE VERTICAL STAB: ',$)
     READ(5,2490,ERR=3095) ZROOT
     IF((ZROOT.LT.0.0).OR.(ZROOT.GT.2.0)) GOTO 3095
     GOTO 3030
3100 WRITE(6,3101)
3101 FORMAT(/7X,'ENTER THE HORIZONTAL TAIL SIZING LOGIC'/
    &7X,'T = ACSYNT WILL RESIZE THE TAIL'/
    &7X,'F = THE INPUT VALUE OF THE TAIL SIZE IS USED: ',$)
     READ(5,3105,ERR=3100) SIZIT
3105 FORMAT(L1)
     GOTO 3030
3110 WRITE(6,3115)
3115 FORMAT(/7X,'ENTER THE HORIZONTAL TAIL SIZING FRACTION.'/
    &7X,'IF 0.0 IS ENTERED THE TAIL WILL BE SIZED USING THE'/
    &7X,'VOLUME COEFFICIENT: ',$)
     READ(5,3117,ERR=3110) HTFRAC
3117 FORMAT(F5.3)
     IF((HTFRAC.LT.0.0).OR.(HTFRAC.GT.1.0)) GOTO 3110
     GOTO 3030
3120 WRITE(7,3125) AR, AREA, CVHT, HTFRAC, SWEEP, SWFACT, TAPER,
    &TCROOT, TCTIP, XHTAIL, ZROOT, KSWEEP, OUTCOD, SIZIT
3125 FORMAT(' $HTAIL'/5X,'AR=',F5.2,',',6X,'AREA=',F7.2,',',2X,
    &'CVHT=',F4.2,','/5X,'HTFRAC=',F5.3,',',2X,'SWEEP=',F5.2,',',
    &3X,'SWFACT=',F4.2,','/5X,'TAPER=',F4.2,',',4X,'TCROOT=',F4.2,
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     &',',3X,'TCTIP=',F4.2,','/5X,'XHTAIL=',F4.2,',',3X,'ZROOT=',
     &F4.2,',',4X,'KSWEEP=',I1,','/5X,'OUTCOD=',I1,','6X,'SIZIT=',
     &L1,','/5X,'$END')
      GOTO 3200
C -----------------------------------------------------------------
C --- VERTICAL TAIL GEOMETRY
C -----------------------------------------------------------------
 3200 IF(VTAIL.EQ.'NO') GOTO 3400
      IF(DVFLAG.EQ..TRUE.) THEN     ! SET VTAIL DEFAULTS
        AR=5.0
        AREA=50.0
        CVVT=0.6
        SWEEP=0.0
        SWFACT=1.0
        TAPER=0.99
        TCROOT=0.1
        TCTIP=0.1
        VTFRAC=0.0
        VTNO=1.0
        XVTAIL=1.0
        YROOT=0.0
        ZROOT=0.0
        KSWEEP=0
        OUTCOD=2
        SIZIT=F
      ELSE            ! READ OLD VTAIL
        REWIND(10)
 3210   READ(10,26) ANS
        IF(ANS.EQ.'$$$$$$') THEN
          AR=5.0
          AREA=0.0
          CVVT=0.08
          SWEEP=0.0
          SWFACT=1.0
          TAPER=0.99
          TCROOT=0.1
          TCTIP=0.1
          VTFRAC=0.0
          VTNO=1.0
          XVTAIL=1.0
          YROOT=0.0
          ZROOT=0.0
          KSWEEP=0
          OUTCOD=2
          SIZIT=F
        ELSE
          IF(ANS.NE.' $VTAI') GOTO 3210
          READ(10,3220) AR, AREA, CVVT, SWEEP, SWFACT, TAPER, TCROOT,
     &    TCTIP, VTFRAC, VTNO, XVTAIL, YROOT, ZROOT, KSWEEP, OUTCOD,
     &    SIZIT
 3220     FORMAT(8X,F5.2,12X,F7.2,8X,F4.2/11X,F5.2,11X,F4.2,10X,F4.2/
     &    12X,F4.2,10X,F4.2,12X,F5.3/10X,F3.1,14X,F4.2,10X,F4.2/
     &    11X,F4.2,12X,I1,14X,I1/11X,L1)
        ENDIF
      ENDIF
 3230 STATUS = LIB$SPAWN('CLS')
      WRITE(6,3240) AR, AREA, CVVT, SWEEP, SWFACT, TAPER, TCROOT,
     &TCTIP, VTNO, XVTAIL, ZROOT, SIZIT, VTFRAC
 3240 FORMAT(/
     &7X,'** VERTICAL TAIL GEOMETRY **'//
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     &7X,'(1)  ASPECT RATIO................................',F5.2/
     &7X,'(2)  TAIL AREA (SQ FT).........................',F7.2/
     &7X,'(3)  TAIL VOLUME COEFFICIENT......................',F4.2/
     &7X,'(4)  LE SWEEP (DEG)..............................',F5.2/
     &7X,'(5)  WETTED AREA MULTIPLIER.......................',F4.2/
     &7X,'(6)  TAPER RATIO..................................',F4.2/
     &7X,'(7)  T/C RATIO AT ROOT............................',F4.2/
     &7X,'(8)  T/C RATIO AT TIP.............................',F4.2/
     &7X,'(9)  NUMBER OF VERTICAL TAILS.....................',F3.1/
     &7X,'(10) X LOCATION OF THE TE OF THE ROOT CHORD'/
     &7X,'     AS A FRACTION OF FUSELAGE LENGTH.............',F4.2/
     &7X,'(11) ELEVATION OF THE ROOT CHORD OF THE TAIL AS'/
     &7X,'     A FRACTION OF THE FUSELAGE RADIUS............',F4.2/
     &7X,'(12) SIZING LOGIC.................................',L1/
     &7X,'     T = ACSYNT WILL COMPUTE TAIL AREA'/
     &7X,'     F = THE INPUT TAIL AREA WILL BE USED'/
     &7X,'(13) VERTICAL TAIL SIZING FRACTION.................',F5.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,2411,ERR=3230) NUM
      IF(NUM.EQ.0) GOTO 3340
      GOTO (3250, 3255, 3260, 3265, 3270, 3275, 3280, 3285, 3290,
     &3300, 3310, 3320, 3330), NUM
      GOTO 3230
 3250 WRITE(6,3251)
 3251 FORMAT(/7X,'ENTER THE ASPECT RATIO: ',$)
      READ(5,2460,ERR=3250) AR
      IF((AR.LT.0.0).OR.(AR.GT.12.0)) GOTO 3250
      GOTO 3230
 3255 WRITE(6,3256)
 3256 FORMAT(/7X,'ENTER THE VERTICAL TAIL AREA (SQ FT): ',$)
      READ(5,2446,ERR=3255) AREA
      IF(AREA.LT.0.0) GOTO 3255
      GOTO 3230
 3260 WRITE(6,3261)
 3261 FORMAT(/7X,'ENTER THE VERTICAL TAIL VOLUME COEFFICIENT: ',$)
      READ(5,2490,ERR=3260) CVVT
      IF((CVVT.LT.0.01).OR.(CVVT.GT.0.2)) GOTO 3260
      GOTO 3230
 3265 WRITE(6,3266)
 3266 FORMAT(/7X,'ENTER THE LE SWEEP OF THE VERTICAL TAIL: ',$)
      READ(5,2460,ERR=3265) SWEEP
      IF((SWEEP.LT.-9.0).OR.(SWEEP.GT.60.0)) GOTO 3265
      GOTO 3230
 3270 WRITE(6,3271)
 3271 FORMAT(/7X,'ENTER THE WETTED AREA MULTIPLIER: ',$)
      READ(5,2490,ERR=3270) SWFACT
      IF((SWFACT.LT.0.0).OR.(SWFACT.GT.2.0)) GOTO 3270
      GOTO 3230
 3275 WRITE(6,3276)
 3276 FORMAT(/7X,'ENTER THE TAPER RATIO: ',$)
      READ(5,2490,ERR=3275) TAPER
      IF((TAPER.LT.0.0).OR.(TAPER.GT.1.0)) GOTO 3275
      GOTO 3230
 3280 WRITE(6,3281)
 3281 FORMAT(/7X,'ENTER THE T/C RATIO AT ROOT: ',$)
      READ(5,2490,ERR=3280) TCROOT
      IF((TCROOT.LT.0.02).OR.(TCROOT.GT.0.18)) GOTO 3280
      GOTO 3230
 3285 WRITE(6,3286)
 3286 FORMAT(/7X,'ENTER THE T/C RATIO AT TIP: ',$)
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      READ(5,2490,ERR=3285) TCTIP
      IF((TCTIP.LT.0.02).OR.(TCTIP.GT.0.18)) GOTO 3285
      GOTO 3230
 3290 WRITE(6,3291)
 3291 FORMAT(/7X,'ENTER THE NUMBER OF VERTICAL TAILS'/
     &7X,'2.0 = 2 SYMMETRICALLY LOCATED TAILS'/
     &7X,'3.0 = 1 TAIL ON CENTERLINE AND 2 SYMMETRICALLY LOCATED'//
     &7X,'NUMBER OF TAILS: ',$)
      READ(5,3295,ERR=3290) VTNO
 3295 FORMAT(F3.1)
      IF((VTNO.NE.1.0).AND.(VTNO.NE.2.0).AND.(VTNO.NE.3.0)) GOTO 3290
      GOTO 3230
 3300 WRITE(6,3301)
 3301 FORMAT(/7X,'ENTER THE POSITION OF THE TE OF THE TAIL ROOT CHORD'/
     &7X,'AS A FRACTION OF FUSELAGE LENGTH: ',$)
      READ(5,2490,ERR=3300) XVTAIL
      IF((XVTAIL.LT.0.0).OR.(XVTAIL.GT.1.0)) GOTO 3300
      GOTO 3230
 3310 WRITE(6,3311)
 3311 FORMAT(/7x,'ENTER THE ELEVATION OF THE ROOT CHORD OF'/
     &7X,'THE VERTICAL TAIL AS A FRACTION OF THE MAXIMUM'/
     &7X,'FUSELAGE RADIUS: ',$)
      READ(5,2490,ERR=3310) ZROOT
      IF((ZROOT.LT.-1.0).OR.(ZROOT.GT.1.0)) GOTO 3310
      GOTO 3230
 3320 WRITE(6,3321)
 3321 FORMAT(/7x,'ENTER THE SIZING LOGIC'/
     &7X,'T = ACSYNT WILL SIZE THE VERTICAL TAIL'/
     &7X,'F = THE INPUT VALUE OF THE TAIL AREA WILL BE USED: ',$)
      READ(5,3105,ERR=3320) SIZIT
      GOTO 3230
 3330 WRITE(6,3335)
 3335 FORMAT(/7X,'ENTER THE VERTICAL TAIL SIZING FRACTION.'/
     &7X,'IF 0.0 IS ENTERED, THE TAIL WILL BE SIZED USING THE'/
     &7X,'VOLUME COEFFICIENT: ',$)
      READ(5,3117,ERR=3330) VTFRAC
      IF((VTFRAC.LT.0.0).OR.(VTFRAC.GT.1.0)) GOTO 3330
      GOTO 3230
 3340 WRITE(7,3341) AR, AREA, CVVT, SWEEP, SWFACT, TAPER, TCROOT,
     &TCTIP, VTFRAC, VTNO, XVTAIL, YROOT, ZROOT, KSWEEP, OUTCOD,
     &SIZIT
 3341 FORMAT(' $VTAIL'/5X,'AR=',F5.2,',',6X,'AREA=',F7.2,',',2X,
     &'CVVT=',F4.2,','/5X,'SWEEP=',F5.2,',',3X,'SWFACT=',F4.2,',',
     &3X,'TAPER=',F4.2,','/5X,'TCROOT=',F4.2,',',3X,'TCTIP=',F4.2,
     &',',4X,'VTFRAC=',F5.3,','/5X,'VTNO=',F3.1,',',6X,'XVTAIL=',
     &F4.2,',',3X,'YROOT=',F4.2,','/5X,'ZROOT=',F4.2,',',4X,
     &'KSWEEP=',I1,',',6X,'OUTCOD=',I1,','/5X,'SIZIT=',L1,','/
     &5X,'$END')
      GOTO 3400
C ----------------------------------------------------------------
C --- CANARD GEOMETRY
C ----------------------------------------------------------------
 3400 IF(CANARD.EQ.'NO') GOTO 3600
      IF(DVFLAG.EQ..TRUE.) THEN    ! SET CANARD DEFAULTS
        AR=5.0
        AREA=50.0
        CVCAN=-.8
        CFRAC=0.0
        SWEEP=0.0
        SWFACT=1.0
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          TAPER=0.99
          TCROOT=0.1
          TCTIP=0.1
          XCAN=0.0
          ZROOT=0.0
          NCAN=1
          KSWEEP=0
          OUTCOD=2
          SIZIT=.FALSE.
        ELSE                  ! GET THE OLD VALUES
          REWIND(10)
 3420     READ(10,26) ANS
          IF(ANS.EQ.'$$$$$$') THEN      ! OLD VALUES NOT FOUND
            AR=5.0
            AREA=0.0
            CVCAN=-1.0
            CFRAC=0.0
            SWEEP=0.0
            SWFACT=1.0
            TAPER=0.99
            TCROOT=0.1
            TCTIP=0.1
            XCAN=0.0
            ZROOT=0.0
            NCAN=1
            OUTCOD=2
            SIZIT=.FALSE.
          ELSE
            IF(ANS.NE.' $CANA') GOTO 3420
C ---       ICAN REMOVED...NOT IN CANARD NAMELIST
            READ(10,3430) AR, AREA, CVCAN, SWEEP, SWFACT, TAPER,
     &      TCROOT, TCTIP, XCAN, ZROOT, NCAN, KSWEEP,
     &      OUTCOD, SIZIT, CFRAC
 3430       FORMAT(8X,F5.2,12X,F7.2,9X,F5.2/11X,F5.2,11X,F4.2,
     &      10X,F4.2/12X,F4.2,10X,F4.2,10X,F4.2/11X,F5.2,24X,
     &      I1/12X,I1,14X,I1,13X,L1/11X,F5.3)
          ENDIF
        ENDIF
 3440 STATUS = LIB$SPAWN('CLS')
      WRITE(6,3450) AR, AREA, CVCAN, SWEEP, SWFACT, TAPER, TCROOT,
     &TCTIP, XCAN, ZROOT, NCAN, SIZIT, CFRAC
 3450 FORMAT(/
     &7X,'** CANARD GEOMETRY **'//
     &7X,'(1)  ASPECT RATIO..............................',F5.2/
     &7X,'(2)  AREA (SQ FT)............................',F7.2/
     &7X,'(3)  CANARD VOLUME COEFFICIENT.................',F5.2/
     &7X,'(4)  SWEEP (DEG).............................. ',F5.2/
     &7X,'(5)  WETTED  REA MULTIPLIER.....................',F4.2/
     &7X,'(6)  TAPER RATIO................................',F4.2/
     &7X,'(7)  T/C RATIO AT ROOT..........................',F4.2/
     &7X,'(8)  T/C RATIO AT TIP...........................',F4.2/
     &7X,'(9)  X LOCATION OF CANARD LE, AS A FRACTION'/
     &7X,'     OF FUSELAGE LENGTH.........................',F4.2/
     &7X,'(10) ELEVATION OF CANARD ON FUSELAGE...........',F5.2/
     &7X,'     (1.0 = TOP, -1.0 = BOTTOM)'/
     &7X,'(11) CANARD LOCATION............................',I1/
     &7X,'     (1 = CANARDS ON CENTRAL BODY)'/
     &7X,'     (2 = CANARDS OUTBOARD OF TWIN NACELLES)'/
     &7X,'(12) SIZING LOGIC...............................',L1/
     &7X,'     (T = CANARD AREA RECOMPUTED BY ACSYNT)'/
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     &7X,'      (F = CANARD AREA FIXED BY INPUT VALUE)'/
     &7X,'(13) CANARD SIZING FRACTION....................',F5.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,2411,ERR=3440) NUM
      IF(NUM.EQ.0) GOTO 3530
      GOTO (3460, 3465, 3470, 3475, 3480, 3485, 3490, 3495, 3500, 3505,
     &3510, 3515, 3520), NUM
      GOTO 3440
 3460 WRITE(6,3461)
 3461 FORMAT(/7X,'ENTER THE ASPECT RATIO: ',$)
      READ(5,2460,ERR=3460) AR
      IF((AR.LE.0.0).OR.(AR.GT.12.0)) GOTO 3460
      GOTO 3440
 3465 WRITE(6,3466)
 3466 FORMAT(/7X,'ENTER THE CANARD AREA (SQ FT). IF YOU'/
     &7X,'WANT ACSYNT TO SIZE THE CANARD BASED ON THE'/
     &7X,'CANARD VOLUME COEFFICIENT, ENTER 0.0: ',$)
      READ(5,2446,ERR=3465) AREA
      IF(AREA.LT.0.0) GOTO 3465
      GOTO 3440
 3470 WRITE(6,3471)
 3471 FORMAT(/7X,'ENTER THE CANARD VOLUME COEFFICIENT'/
     &7X,'(THIS SHOULD BE A NEGATIVE VALUE): ',$)
      READ(5,2460,ERR=3470) CVCAN
      IF((CVCAN.LT.-1.0).OR.(CVCAN.GT.0.0)) GOTO 3470
      GOTO 3440
 3475 WRITE(6,3476)
 3476 FORMAT(/7X,'ENTER THE LEADING EDGE SWEEP (DEG): ',$)
      READ(5,2460,ERR=3475) SWEEP
      IF((SWEEP.LT.-9.0).OR.(SWEEP.GT.60.0)) GOTO 3475
      GOTO 3440
 3480 WRITE(6,3481)
 3481 FORMAT(/7X,'ENTER THE WETTED AREA MULTIPLIER: ',$)
      READ(5,2490,ERR=3480) SWFACT
      IF((SWFACT.LE.0.0).OR.(SWFACT.GT.2.0)) GOTO 3480
      GOTO 3440
 3485 WRITE(6,3486)
 3486 FORMAT(/7X,'ENTER THE TAPER RATIO: ',$)
      READ(5,2490,ERR=3485) TAPER
      IF((TAPER.LT.0.0).OR.(TAPER.GT.1.0)) GOTO 3485
      GOTO 3440
 3490 WRITE(6,3491)
 3491 FORMAT(/7X,'ENTER THE T/C RATIO AT THE ROOT: ',$)
      READ(5,2490,ERR=3490) TCROOT
      IF((TCROOT.LT.0.02).OR.(TCROOT.GT.0.18)) GOTO 3490
      GOTO 3440
 3495 WRITE(6,3496)
 3496 FORMAT(/7X,'ENTER THE T/C RATIO AT THE TIP: ',$)
      READ(5,2490,ERR=3495) TCTIP
      IF((TCTIP.LT.0.02).OR.(TCTIP.GT.0.18)) GOTO 3495
      GOTO 3440
 3500 WRITE(6,3501)
 3501 FORMAT(/7X,'ENTER THE X LOCATION OF THE LEADING EDGE'/
     &7X,'OF THE CANARD AS A FRACTION OF THE FUSELAGE'/
     &7X,'LENGTH: ',$)
      READ(5,2490,ERR=3500) XCAN
      IF((XCAN.LT.0.0).OR.(XCAN.GT.0.5)) GOTO 3500
      GOTO 3440
 3505 WRITE(6,3506)
 3506 FORMAT(/7X,'ENTER THE ELEVATION OF THE CANARD ON THE'/
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     &7X,'FUSELAGE (1.0 = TOP OF FUSELAGE, -1.0 = BOTTOM'/
     &7X,'OF FUSELAGE): ',$)
      READ(5,2460,ERR=3505) ZROOT
      IF((ZROOT.LT.-1.0).OR.(ZROOT.GT.1.0)) GOTO 3505
      GOTO 3440
 3510 WRITE(6,3511)
 3511 FORMAT(/7X,'ENTER THE CANARD LOCATION CODE'/
     &7X,'(1 = CANARD IS ON THE CENTRAL BODY)'/
     &7X,'(2 = CANARD IS MOUNTED OUTBOARD OF TWIN NACELLES): ',$)
      READ(5,2940,ERR=3510) NCAN
      IF((NCAN.NE.1).AND.(NCAN.NE.2)) GOTO 3510
      GOTO 3440
 3515 WRITE(6,3516)
 3516 FORMAT(/7X,'ENTER THE CANARD SIZING LOGIC'/
     &7X,'(T = ACSYNT MAY RESIZE THE CANARD)'/
     &7X,'(F = THE INPUT VALUE OF CANARD SIZE WILL BE USED): ',$)
      READ(5,3105,ERR=3515) SIZIT
      GOTO 3440
 3520 WRITE(6,3525)
 3525 FORMAT(/7X,'ENTER THE CANARD SIZING FRACTION. IF 0.0'/
     &7X,'IS ENTERED, THE CANARD WILL BE SIZED USING THE'/
     &7X,'VOLUME COEFFICIENT: ',$)
      READ(5,3117,ERR=3520) CFRAC
      IF((CFRAC.LT.0.0).OR.(CFRAC.GT.1.0)) GOTO 3520
      GOTO 3440
 3530 WRITE(7,3531) AR, AREA, CVCAN, SWEEP, SWFACT, TAPER, TCROOT,
     &TCTIP, XCAN, ZROOT, NCAN, KSWEEP, OUTCOD, SIZIT, CFRAC
 3531 FORMAT(' $CANARD'/5X,'AR=',F5.2,',',6X,'AREA=',F7.2,',',
     &2X,'CVCAN=',F5.2,','/5X,'SWEEP=',F5.2,',',3X,'SWFACT=',
     &F4.2,',',3X,'TAPER=',F4.2,','/5X,'TCROOT=',F4.2,',',3X,
     &'TCTIP=',F4.2,',',4X,'XCAN=',F4.2,','/5X,'ZROOT=',F5.2,
     &',',18X,'NCAN=',I1,','/5X,'KSWEEP=',I1,
     &',',6X,'OUTCOD=',I1,',',6X,'SIZIT=',L1,','/5X,'CFRAC=',F5.3,
     &',',3X,'$END')
      GOTO 3600
C ---------------------------------------------------------------
C --- WING POD GEOMETRY
C ---------------------------------------------------------------
 3600 IF(WPOD.EQ.'NO') GOTO 3700
 3602 STATUS = LIB$SPAWN('CLS')
      WRITE(6,3603)
 3603 FORMAT(//7X,'ENTER THE NUMBER OF WING PODS. IF THE PODS ARE'/
     &7X,'SYMMETRICALLY MOUNTED AROUND THE FUSELAGE, JUST ENTER'/
     &7X,'THE NUMBER OF PODS ON ONE SIDE OF THE AIRCRAFT AND'/
     &7X,'SELECT THE WING POD SYMMETRY CODE. (A MAXIMUM TOTAL OF'/
     &7X,'10 PODS MAY BE USED'//
     &7X,'NUMBER OF PODS: ',$)
      READ(5,2411,ERR=3602) PODNUM
      IF((PODNUM.GT.10).OR.(PODNUM.LT.1)) GOTO 3602
      DO 3690 I=1,PODNUM
        IF((DVFLAG.EQ..TRUE.).OR.(WPODFL.EQ.1)) THEN    ! SET DEFAULTS
          DIAM=3.0
          LENGTH=10.0
          X=0.0
          Y=0.5
          Z=-1.0
          OUTCOD=2
          SYMCOD=0
        ELSE
          IF(I.EQ.1) REWIND(10)
```

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3610      READ(10,26) ANS
          IF(ANS.EQ.'$$$$$$') THEN
            WPODFL=1        ! FLAG TO PREVENT EOF ERROR
            DIAM=3.0
            LENGTH=10.0
            X=0.0
            Y=0.5
            Z=-1.0
            OUTCOD=2
            SYMCOD=0
          ELSE
            IF(ANS.NE.' $WPOD') GOTO 3610
            READ(10,3615) DIAM, LENGTH, X, Y, Z, OUTCOD, SYMCOD
3615        FORMAT(10X,F6.2,11X,F6.2,4X,F5.2/7X,F3.1,12X,F5.2,
     &      15X,I1/12X,I1)
          ENDIF
        ENDIF
3620    STATUS = LIB$SPAWN('CLS')
        WRITE(6,3625) I, DIAM, LENGTH, X, Y, Z, SYMCOD
3625    FORMAT(/
     &  7X,'** WING ENGINE POD NUMBER ',I1,' **'//
     &  7X,'(1) ENGINE DIAMETER (FT).......................',F6.2/
     &  7X,'(2) ENGINE LENGTH (FT).........................',F6.2/
     &  7X,'(3) X LOCATION OF POD, RELATIVE TO THE WING LE,'/
     &  7X,'    AS A FRACTION OF LOCAL CHORD................',F5.2/
     &  7X,'(4) Y LOCATION OF CENTER OF POD MEASURED FROM'/
     &  7X,'    FUSELAGE CENTERLINE, AS A FRACTION OF '/
     &  7X,'    WING SEMI-SPAN..............................',F3.1/
     &  7X,'(5) Z LOCATION OF WING POD, GIVEN AS A FRACTION'/
     &  7X,'    OF MAXIMUM POD DIAMETER, RELATIVE TO WING...',F5.2/
     &  7X,'    ( <0 IF POD IS BELOW WING, >0 IF ABOVE)'/
     &  7X,'(6) WING POD SYMMETRY...........................',I1/
     &  7X,'    (0 = WING POD HAS IMAGE ON OPPOSITE WING)'/
     &  7X,'    (1 = WING POD DOES NOT HAVE AN IMAGE)'//
     &  7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
        READ(5,21,ERR=3620) NUM
        IF(NUM.EQ.0) GOTO 3670
        GOTO (3630, 3640, 3645, 3650, 3660, 3665) ,NUM
        GOTO 3620
3630    WRITE(6,3631)
3631    FORMAT(/7X,'ENTER THE POD DIAMETER (FEET): ',$)
        READ(5,3635,ERR=3630) DIAM
        IF((DIAM.LE.0.0).OR.(DIAM.GT.30.0)) GOTO 3630
3635    FORMAT(F6.2)
        GOTO 3620
3640    WRITE(6,3641)
3641    FORMAT(/7X,'ENTER THE POD LENGTH (FEET): ',$)
        READ(5,3635,ERR=3640) LENGTH
        IF((LENGTH.LE.0.0).OR.(LENGTH.GT.40.0)) GOTO 3640
        GOTO 3620
3645    WRITE(6,3646)
3646    FORMAT(/7X,'ENTER THE X LOCATION OF THE WING POD'/
     &  7X,'RELATIVE TO THE LEADING EDGE OF THE WING'/
     &  7X,'AS A FRACTION OF THE LOCAL CHORD (POSITIVE'/
     &  7X,'BEHIND THE LE): ',$)
        READ(5,2460,ERR=3645) X
        IF((X.LT.-1.0).OR.(X.GT.1.0)) GOTO 3645
        GOTO 3620
3650    WRITE(6,3651)
3651    FORMAT(/7X,'ENTER THE Y LOCATION OF THE WING POD'/
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     &   7X,'RELATIVE TO THE FUSELAGE CENTERLINE AS A'/
     &   7X,'FRACTION OF THE WING SEMI-SPAN: ',$)
         READ(5,3655,ERR=3650) Y
 3655    FORMAT(F3.1)
         IF((Y.LT.0.0).OR.(Y.GT.1.0)) GOTO 3650
         GOTO 3620
 3660    WRITE(6,3661)
 3661    FORMAT(/7X,'ENTER THE Z LOCATION OF THE WING POD'/
     &   7X,'RELATIVE TO THE WING, AS A FRACTION OF THE'/
     &   7X,'MAXIMUM POD DIAMETER: ',$)
         READ(5,2460,ERR=3660) Z
         IF((Z.LT.-2.0).OR.(Z.GT.2.0)) GOTO 3660
         GOTO 3620
 3665    WRITE(6,3666)
 3666    FORMAT(/7X,'ENTER THE WING POD SYMMETRY CODE:'/
     &   7X,'(0 = POD HAS AN IMAGE ON OPPOSITE WING)'/
     &   7X,'(1 = POD DOES NOT HAVE AN IMAGE) ',$)
         READ(5,2940,ERR=3665) SYMCOD
         IF((SYMCOD.NE.0).AND.(SYMCOD.NE.1)) GOTO 3665
         GOTO 3620
 3670    WRITE(7,3671) DIAM, LENGTH, X, Y, Z, OUTCOD, SYMCOD
 3671    FORMAT(' $WPOD'/5X,'DIAM=',F6.2,',',3X,'LENGTH=',F6.2,',',
     &     1X,'X=',F5.2,','/5X,'Y=',F3.1,',',9X,'Z=',F5.2,',',
     &     7X,'OUTCOD=',I1,','/5X,'SYMCOD=',I1,','/5X,'$END')
 3690 CONTINUE
C ---------------------------------------------------------------------
C --- FUSELAGE POD GEOMETRY
C ---------------------------------------------------------------------
 3700 IF(FPOD.EQ.'NO') GOTO 3800
 3702 STATUS = LIB$SPAWN('CLS')
      WRITE(6,3703)
 3703 FORMAT(//7X,'ENTER THE NUMBER OF FUSELAGE PODS. IF THE PODS'/
     &7X,'ARE SYMMETRICALLY MOUNTED AROUND THE FUSELAGE, JUST'/
     &7X,'ENTER THE NUMBER OF PODS ON ONE SIDE OF THE AIRCRAFT AND'/
     &7X,'SELECT THE POD SYMMETRY CODE. (A MAXIMUM TOTAL OF'/
     &7X,'10 PODS MAY BE USED'//
     &7X,'NUMBER OF PODS: ',$)
      READ(5,2411,ERR=3602) PODNUM
      IF((PODNUM.GT.10).OR.(PODNUM.LT.1)) GOTO 3702
      DO 3790 I=1,PODNUM
        IF((DVFLAG.EQ..TRUE.).OR.(FPODFL.EQ.1)) THEN     ! SET DEFAULTS
          DIAM=3.0
          LENGTH=10.0
          SOD=0.1
          THETA=0.0
          X=0.8
          OUTCOD=2
          SYMCOD=0
        ELSE
          IF(I.EQ.1) REWIND(10)
 3710     READ(10,26) ANS
          IF(ANS.EQ.'$$$$$$') THEN  ! OLD $FPOD NOT FOUND. SET DEFAULTS
          FPODFL=1
          DIAM=3.0
          LENGTH=10.0
          SOD=0.1
          THETA=0.0
          X=0.8
          OUTCOD=2
          SYMCOD=0
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          ELSE
            IF(ANS.NE.' $FPOD') GOTO 3710
            READ(10,3715) DIAM, LENGTH, SOD, THETA, X, OUTCOD, SYMCOD
3715        FORMAT(10X,F6.2,11X,F6.2,6X,F5.2/11X,F5.2,6X,F3.1,17X,I1/
     &      12X,I1)
          ENDIF
        ENDIF
3720    STATUS = LIB$SPAWN('CLS')
        WRITE(6,3725) I, DIAM, LENGTH, SOD, THETA, X, SYMCOD
3725    FORMAT(/
     &  7X,'** FUSELAGE ENGINE POD NUMBER ',I1, ' **'//
     &  7X,'(1) ENGINE POD DIAMETER (FT)....................',F6.2/
     &  7X,'(2) ENGINE POD LENGTH (FT)......................',F6.2/
     &  7X,'(3) STAND-OFF DISTANCE..........................',F5.2/
     &  7X,'     (0.0 = COTANGENT POD)'/
     &  7X,'     (-1.0 = SEMI-BURIED POD)'/
     &  7X,'     (-2.0 = FULLY BURIED POD)'/
     &  7X,'(4) ANGULAR ORIENTATION OF POD (DEG).............',F5.2/
     &  7X,'     (0.0 DEG = POD IS MOUNTED AT 3 OCLOCK)'/
     &  7X,'     (90 DEG = POD IS MOUNTED ON TOP OF FUSELAGE)'/
     &  7X,'(5) X LOCATION OF THE LE OF POD, RELATIVE TO THE'/
     &  7X,'    NOSE OF THE FUSELAGE, GIVEN AS A FRACTION OF'/
     &  7X,'    THE FUSELAGE LENGTH............................',F3.1/
     &  7X,'(6) WING POD SYMMETRY..............................',I1/
     &  7X,'     (0 = WING POD HAS IMAGE ON OPPOSITE WING)'/
     &  7X,'     (1 = WING POD DOES NOT HAVE AN IMAGE)'//
     &  7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
        READ(5,21,ERR=3720) NUM
        IF(NUM.EQ.0) GOTO 3770
        GOTO (3730, 3740, 3745, 3750, 3760, 3765) ,NUM
        GOTO 3720
3730    WRITE(6,3731)
3731    FORMAT(/7X,'ENTER THE POD DIAMETER (FEET): ',$)
        READ(5,3635,ERR=3730) DIAM
        IF((DIAM.LE.0.0).OR.(DIAM.GT.30.0)) GOTO 3730
        GOTO 3720
3740    WRITE(6,3741)
3741    FORMAT(/7X,'ENTER THE POD LENGTH (FEET): ',$)
        READ(5,3635,ERR=3740) LENGTH
        IF((LENGTH.LE.0.0).OR.(LENGTH.GT.40.0)) GOTO 3740
        GOTO 3720
3745    WRITE(6,3746)
3746    FORMAT(/7X,'ENTER THE POD STAND-OFF DISTANCE'/
     &  7X,'(0.0 = COTANGENT POD)'/
     &  7X,'(-1.0 = SEMI-BURIED POD)'/
     &  7X,'(-2.0 = FULLY BURIED POD): ',$)
        READ(5,2460,ERR=3745) SOD
        IF((SOD.LT.-2.0).OR.(SOD.GT.3.0)) GOTO 3745
        GOTO 3720
3750    WRITE(6,3751)
3751    FORMAT(/7X,'ENTER THE ANGULAR ORIENTATION OF THE FUSELAGE'/
     &  7X,'POD AS SEEN FROM THE FRONT OF THE AIRCRAFT.'/
     &  7X,'0.0 = 3 OCLOCK POSITION'/
     &  7X,'90.0 = 12 OCLOCK POSITION: ',$)
        READ(5,2460,ERR=3750) THETA
        IF((THETA.GT.90.0).OR.(THETA.LT.-90.0)) GOTO 3750
        GOTO 3720
3760    WRITE(6,3761)
3761    FORMAT(/7X,'ENTER THE X LOCATION OF THE LEADING EDGE OF'/
     &  7X,'THE FUSELAGE POD, RELATIVE TO THE AIRCRAFT NOSE, AS'/
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     &  7X,'A FRACTION OF THE FUSELAGE LENGTH: ',$)
        READ(5,3762,ERR=3760) X
        IF((X.LT.0.0).OR.(X.GT.1.0)) GOTO 3760
 3762   FORMAT(F3.1)
        GOTO 3720
 3765   WRITE(6,3766)
 3766   FORMAT(/7X,'ENTER THE FUSELAGE POD SYMMETRY CODE:'/
     &  7X,'(0 = POD HAS AN IMAGE ON OPPOSITE SIDE)'/
     &  7X,'(1 = POD DOES NOT HAVE AN IMAGE) ',$)
        READ(5,2940,ERR=3765) SYMCOD
        IF((SYMCOD.NE.0).AND.(SYMCOD.NE.1)) GOTO 3765
        GOTO 3720
 3770   WRITE(7,3771) DIAM, LENGTH, SOD, THETA, X, OUTCOD, SYMCOD
 3771   FORMAT(' $FPOD'/5X,'DIAM=',F6.2,',',3X,'LENGTH=',F6.2,',',
     &  1X,'SOD=',F5.2,','/5X,'THETA=',F5.2,',',3X,'X=',F3.1,',',
     &  9X,'OUTCOD=',I1,','/5X,'SYMCOD=',I1,','/5X,'$END')
 3790 CONTINUE
C ---------------------------------------------------------------------
C --- FUSELAGE GEOMETRY
C ---------------------------------------------------------------------
 3800 IF(DVFLAG.EQ..TRUE.) THEN      ! SET $FUS DEFAULTS
        BDMAX=5.0
        BODL=50.0
        DRADAR=0.0
        FRAB=2.0
        FRATIO=0.0
        FRN=3.0
        LRADAR=0.0
        SFFACT=1.0
        WALL=0.0
        WFUEL=5000.0
        OUTCOD=2
        ITAIL=0
      ELSE              ! GET THE OLD VALUES
        REWIND(10)
 3805   READ(10,26) ANS
        IF(ANS.EQ.'$$$$$$') THEN    ! OLD $FUS NOT FOUND. SET DEFAULTS
          BDMAX=5.0
          BODL=50.0
          DRADAR=0.0
          FRAB=2.0
          FRATIO=0.0
          FRN=3.0
          LRADAR=0.0
          SFFACT=1.0
          WALL=0.0
          WFUEL=5000.0
          OUTCOD=2
          ITAIL=0
        ELSE
          IF(ANS.NE.' $FUS ') GOTO 3805
          READ(10,3810) BDMAX, BODL, DRADAR, FRAB, FRATIO, FRN, LRADAR,
     &    SFFACT, WALL, WFUEL, OUTCOD, ITAIL
 3810     FORMAT(11X,F5.2,9X,F6.2,11X,F5.2/10X,F5.2,12X,F5.2,7X,F5.2/
     &    12X,F5.2,10X,F5.2,8X,F5.2/11X,F8.1,8X,I1,13X,I1)
        ENDIF
      ENDIF
 3815 STATUS = LIB$SPAWN('CLS')
      WRITE(6,3820) BDMAX, BODL, DRADAR, FRAB, FRATIO, FRN, LRADAR,
     &SFFACT, WALL, WFUEL, ITAIL
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3820 FORMAT(/
    &7X,'** FUSELAGE GEOMETRY **'//
    &7X,'(1)  MAXIMUM FUSELAGE DIAMETER (FT)............',F5.2/
    &7X,'(2)  FUSELAGE LENGTH (FT)......................',F6.2/
    &7X,'(3)  DIAMETER OF NOSE RADAR DISH (FT)..........',F5.2/
    &7X,'(4)  AFTERBODY FINENESS RATIO (LENGTH/DIAM)....',F5.2/
    &7X,'(5)  FUSELAGE FINENESS RATIO (LENGTH/DIAM).....',F5.2/
    &7X,'(6)  NOSE FINENESS RATIO (LENGTH/DIAM).........',F5.2/
    &7X,'(7)  LENGTH OF RADAR EQUIP BEHIND RADAR (FT)...',F5.2/
    &7X,'(8)  SURFACE AREA COMPLEXITY FACTOR............',F5.2/
    &7X,'(9)  FUSELAGE WALL THICKNESS (FT)'/
    &7X,'     (TRANSPORTS ONLY).........................',F5.2/
    &7X,'(10) MISSION FUEL WEIGHT ESTIMATE (LBS)....',F8.1/
    &7X,'(11) TAIL TYPE.................................',I1/
    &7X,'      (0 = ENGINE NOZZLE AT REAR OF FUSELAGE)'/
    &7X,'      (1 = FUSELAGE TAPERS DOWN WITHOUT A NOZZLE)'//
    &7X,'SELECT A VALUE TO CHANGE OR 0 TO QUIT: ',$)
     READ(5,2411,ERR=3815) NUM
     IF(NUM.EQ.0) GOTO 3885
     GOTO (3825, 3830, 3835, 3840, 3845, 3850, 3855, 3860, 3865,
    &3870, 3880), NUM
     GOTO 3815
3825 WRITE(6,3826)
3826 FORMAT(/7X,'ENTER THE MAXIMUM DIAMETER OF THE FUSELAGE: ',$)
     READ(5,2460,ERR=3825) BDMAX
     IF(BDMAX.LE.0.0) GOTO 3825
     GOTO 3815
3830 WRITE(6,3831)
3831 FORMAT(/7X,'ENTER THE FUSELAGE LENGTH (FT): ',$)
     READ(5,2475,ERR=3830) BODL
     IF(BODL.LE.0.0) GOTO 3830
     GOTO 3815
3835 WRITE(6,3836)
3836 FORMAT(/7X,'ENTER THE DIAMETER OF THE NOSE MOUNTED'/
    &7X,'RADAR DISH (FT): ',$)
     READ(5,2460,ERR=3835) DRADAR
     IF((DRADAR.LT.0.0).OR.(DRADAR.GT.20.0)) GOTO 3835
     GOTO 3815
3840 WRITE(6,3841)
3841 FORMAT(/7X,'ENTER THE FINENESS RATIO OF THE AFTERBODY'/
    &7X,'(AFTERBODY LENGTH/DIAMETER): ',$)
     READ(5,2460,ERR=3840) FRAB
     IF((FRAB.LT.0.0).OR.(FRAB.GT.99.99)) GOTO 3840
     GOTO 3815
3845 WRITE(6,3846)
3846 FORMAT(/7X,'ENTER THE TOTAL FUSELAGE FINENESS RATIO'/
    &7X,'(FUSELAGE LENGTH/MAX DIAMETER): ',$)
     READ(5,2460,ERR=3845) FRATIO
     IF((FRATIO.LT.0.0).OR.(FRATIO.GT.99.99)) GOTO 3845
     GOTO 3815
3850 WRITE(6,3851)
3851 FORMAT(/7X,'ENTER THE FINENESS RATIO OF THE NOSE'/
    &7X,'(NOSE LENGTH/DIAMETER): ',$)
     READ(5,2460,ERR=3850) FRN
     IF((FRN.LT.0.0).OR.(FRN.GT.99.99)) GOTO 3850
     GOTO 3815
3855 WRITE(6,3856)
3856 FORMAT(/7X,'ENTER THE LENGTH OF THE RADAR EQUIPMENT THAT'/
    &7X,'IS LOCATED BEHIND THE RADAR (FT): ',$)
     READ(5,2460,ERR=3855) LRADAR
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      IF((LRADAR.LT.0.0).OR.(LRADAR.GT.30.0)) GOTO 3855
      GOTO 3815
 3860 WRITE(6,3861)
 3861 FORMAT(/7X,'ENTER THE FUSELAGE SURFACE AREA'/
     &7X,'COMPLEXITY FACTOR: ',$)
      READ(5,2460,ERR=3860) SFFACT
      IF((SFFACT.LE.0.0).OR.(SFFACT.GT.2.0)) GOTO 3860
      GOTO 3815
 3865 WRITE(6,3866)
 3866 FORMAT(/7X,'ENTER THE THICKNESS OF THE FUSELAGE WALL (FT)'/
     &7X,'(USED FOR TRANSPORT AIRCRAFT ONLY): ',$)
      READ(5,2460,ERR=3865) WALL
      IF((WALL.LT.0.0).OR.(WALL.GT.1.0)) GOTO 3865
      GOTO 3815
 3870 WRITE(6,3871)
 3871 FORMAT(/7X,'ENTER AN ESTIMATE FOR THE MISSION FUEL'/
     &7X,'WEIGHT (LBS): ',$)
      READ(5,3875,ERR=3870) WFUEL
 3875 FORMAT(F8.1)
      IF(WFUEL.LT.0.0) GOTO 3870
      GOTO 3815
 3880 WRITE(6,3881)
 3881 FORMAT(/7X,'ENTER THE TAIL INDICATOR'/
     &7X,'(0 = ENGINE NOZZLE AT REAR OF FUSELAGE)'/
     &7X,'(1 = FUSELAGE TAPERS DOWN WITHOUT A NOZZLE): ',$)
      READ(5,2940,ERR=3880) ITAIL
      IF((ITAIL.NE.0).AND.(ITAIL.NE.1)) GOTO 3880
      GOTO 3815
 3885 WRITE(7,3886) BDMAX, BODL, DRADAR, FRAB, FRATIO, FRN, LRADAR,
     &SFFACT, WALL, WFUEL, OUTCOD, ITAIL
 3886 FORMAT(' $FUS'/5X,'BDMAX=',F5.2,',',3X,'BODL=',F6.2,',',3X,
     &'DRADAR=',F5.2,','/5X,'FRAB=',F5.2,',',4X,'FRATIO=',F5.2,',',
     &2X,'FRN=',F5.2,','/5X,'LRADAR=',F5.2,',',2X,'SFFACT=',F5.2,
     &',',2X,'WALL=',F5.2,','/5X,'WFUEL=',F8.1,',','OUTCOD=',I1,',',
     & 6X,'ITAIL=',I1,','/5X,'$END')
      GOTO 4100
C ----------------------------------------------------------------------
C --- CREW STATION GEOMETRY
C ----------------------------------------------------------------------
 4100 IF(CREW.EQ.'NO') GOTO 4300
      IF(DVFLAG.EQ..TRUE.) THEN
        LENGTH=0.0
        WIDTH=0.0
        NCREW=2
        OUTCOD=2
        TAND=.FALSE.
      ELSE
        REWIND(10)
 4105   READ(10,26) ANS
        IF(ANS.EQ.'$$$$$$') THEN
          LENGTH=0.0
          WIDTH=0.0
          NCREW=2
          OUTCOD=2
          TAND=.FALSE.
        ELSE
          IF(ANS.NE.' $CREW') GOTO 4105
          READ(10,4110) LENGTH, WIDTH, NCREW, OUTCOD, TAND
 4110     FORMAT(12X,F6.2,8X,F6.2,9X,I2/12X,I1,12X,L1)
        ENDIF
```

```
      ENDIF
 4115 STATUS = LIB$SPAWN('CLS')
      WRITE(6,4120) LENGTH, WIDTH, NCREW, TAND
 4120 FORMAT(/
     &7X,'** CREW STATION GEOMETRY **'//
     &7X,'(1) LENGTH OF CREW STATION (FT)......',F6.2/
     &7X,'(2) WIDTH OF CREW STATION (FT).......',F6.2/
     &7X,'(3) NUMBER OF CREWMEMBERS............',I2/
     &7X,'(4) SEATING ARRANGEMENT...............',L1/
     &7X,'     (T = TANDOM SEATING)'/
     &7X,'     (F = 2 ABREAST SEATING)'//
     &7X,'SELECT THE VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,2940,ERR=4115) NUM
      IF(NUM.EQ.0) THEN
        WRITE(7,4130)  LENGTH, WIDTH, NCREW, OUTCOD, TAND
 4130   FORMAT(' $CREW'/5X,'LENGTH=',F6.2,',',1X,'WIDTH=',F6.2,',',2X,
     &  'NCREW=',I2,','/5X,'OUTCOD=',I1,',',6X,'TAND=',L1,','/5X,'$END')
        GOTO 4300
      ENDIF
      GOTO (4140, 4150, 4160, 4170) ,NUM
      GOTO 4115
 4140 WRITE(6,4145)
 4145 FORMAT(/7X,'ENTER THE LENGTH OF THE CREW STATION (FT).'/
     &7X,'IF 0.0 IS ENTERED, ACSYNT WILL SIZE IT: ',$)
      READ(5,2475,ERR=4140) LENGTH
      IF((LENGTH.LT.0.0).OR.(LENGTH.GT.30.0)) GOTO 4140
      GOTO 4115
 4150 WRITE(6,4155)
 4155 FORMAT(/7X,'ENTER THE WIDTH OF THE CREW STATION.'/
     &7X,'IF 0.0 IS ENTERED, ACSYNT WILL SIZE IT: ',$)
      READ(5,2475,ERR=4150) WIDTH
      IF((WIDTH.LT.0.0).OR.(WIDTH.GT.20.0)) GOTO 4150
      GOTO 4115
 4160 WRITE(6,4165)
 4165 FORMAT(/7X,'ENTER THE NUMBER OF CREWMEMBERS: ',$)
      READ(5,2411,ERR=4160) NCREW
      IF(NCREW.LT.0) GOTO 4160
      GOTO 4115
 4170 WRITE(6,4175)
 4175 FORMAT(/7X,'ENTER THE SEATING ARRANGEMENT.'/
     &7X,'(T = TANDEM SEATING)'/7X,'(F = 2 ABREAST SEATING): ',$)
      READ(5,3105,ERR=4170) TAND
      GOTO 4115
C -----------------------------------------------------------------------
C --- FUSELAGE FUEL BAYS
C -----------------------------------------------------------------------
 4300 IF(FUEL.EQ.'NO') GOTO 4700
      STATUS = LIB$SPAWN('CLS')
 4301 WRITE(6,4305)
 4305 FORMAT(//
     &7X,'HOW MANY FUSELAGE FUEL BAYS ARE THERE ?'//
     &7X,'(1) ONE FUEL BAY'/7X,'(2) TWO FUEL BAYS'//
     &7X,'SELECT 1 OR 2: ',$)
      READ(5,2940,ERR=4301) NUM
      GOTO (4350, 4500) NUM
      GOTO 4301
C --- 1 FUEL BAY
 4350 IF(DVFLAG.EQ..TRUE.) THEN
        DEN=48.62
        FRAC=1.0
```

```
          WFUEL=0.0
          OUTCOD=2
        ELSE
          REWIND(10)
 4355     READ(10,26) ANS
          IF(ANS.EQ.'$$$$$$') THEN
            DEN=50.
            FRAC=1.0
            OUTCOD=2
          ELSE
            IF(ANS.NE.' $FUEL') GOTO 4355
            READ(10,4360) DEN, FRAC, WFUEL, OUTCOD
 4360       FORMAT(9X,F5.2,11X,F4.2,12X,F8.1/12X,I1)
            FRAC=1.0     ! ONLY ONE FUEL BAY HERE
          ENDIF
        ENDIF
 4365 STATUS = LIB$SPAWN('CLS')
      WRITE(6,4370) DEN
 4370 FORMAT(/
     &7X,'** FUSELAGE FUEL BAY **'//
     &7X,'(1) FUEL DENSITY (LBS/FT3)......',F5.2//
     &7X'SELECT THE VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,2940,ERR=4365) NUM
      IF(NUM.EQ.0) THEN
        WRITE(7,4375) DEN, FRAC, WFUEL, OUTCOD
 4375   FORMAT(' $FUEL'/5X,'DEN=',F5.2,',',5X,'FRAC=',F4.2,',',5X,
     &  'WFUEL=',F8.1,','/5X,'OUTCOD=',I1,','/5X,'$END')
      GOTO 4700
      ENDIF
      GOTO (4380) ,NUM
      GOTO 4365
 4380 WRITE(6,4385)
 4385 FORMAT(/7X,'ENTER THE FUEL DENSITY (LB/FT3): ',$)
      READ(5,2460,ERR=4380) DEN
      IF(DEN.LT.0.0) GOTO 4380
      GOTO 4365
C --- 2 FUEL BAYS
 4500 CONTINUE
      IF(DVFLAG.EQ..TRUE.) THEN
        DEN1=50.
        DEN2=50.
        FRAC=0.5
        WFUEL=0.0
        OUTCOD=2
      ELSE
        REWIND(10)
 4505   READ(10,26) ANS
        IF(ANS.EQ.'$$$$$$') THEN
          DEN1=48.62
          DEN2=48.62
          FRAC=0.5
          WFUEL=0.0
          OUTCOD=2
        ELSE
          IF(ANS.NE.' $FUEL') GOTO 4505
          READ(10,4510) DEN1, FRAC, WFUEL, OUTCOD
 4510     FORMAT(9X,F5.2,11X,F4.2,12X,F8.1/12X,I1)
          FRAC=0.5     ! 2 FUEL BAYS HERE
 4515     READ(10,26) ANS
          IF(ANS.EQ.'$$$$$$') THEN
```

```
            DEN2=50.0
          ELSE
            IF(ANS.NE.' $FUEL') GOTO 4515
            READ(10,4520) DEN2
 4520       FORMAT(9X,F5.2)
          ENDIF
        ENDIF
      ENDIF
 4530 STATUS = LIB$SPAWN('CLS')
      WRITE(6,4535) DEN1, DEN2
 4535 FORMAT(/
     &7X,'** FUSELAGE FUEL BAY GEOMETRY **'//
     &7X,'(1) FUEL DENSITY IN FUEL BAY NUMBER 1 (LB/FT3)...',F5.2/
     &7X,'(2) FUEL DENSITY IN FUEL BAY NUMBER 2 (LB/FT3)...',F5.2//
     &7X,'SELECT THE VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,2940,ERR=4530) NUM
      IF(NUM.EQ.0) THEN
        WRITE(7,4540) DEN1, FRAC, WFUEL, OUTCOD, DEN2, FRAC, WFUEL,
     &  OUTCOD
 4540   FORMAT(' $FUEL'/5X,'DEN=',F5.2,',',5X,'FRAC=',F4.2,',',5X,
     &  'WFUEL=',F8.1,','/5X,'OUTCOD=',I1,','/5X,'$END'/
     &  ' $FUEL'/5X,'DEN=',F5.2,',',5X,'FRAC=',F4.2,',',5X,
     &  'WFUEL=',F8.1,','/5X,'OUTCOD=',I1,','/5X,'$END')
        GOTO 4700
      ENDIF
      GOTO (4550, 4560) ,NUM
      GOTO 4530
 4550 WRITE(6,4555)
 4555 FORMAT(/7X,'ENTER THE FUEL DENSITY IN BAY NUMBER 1 (LB/FT3): ',$)
      READ(5,2460,ERR=4550) DEN1
      IF(DEN1.LT.0.0) GOTO 4550
      GOTO 4530
 4560 WRITE(6,4565)
 4565 FORMAT(/7X,'ENTER THE FUEL DENSITY IN BAY NUMBER 2 (LB/FT3): ',$)
      READ(5,2460,ERR=4560) DEN2
      IF(DEN2.LT.0.0) GOTO 4560
      GOTO 4530
 4700 WRITE(7,4705)
 4705 FORMAT(80('$'))
      RETURN
      END
C ---------------------------------------------------------------------
C --- THIS SETS THE $WING NAMELIST DEFAULT VALUES
C ---------------------------------------------------------------------
      SUBROUTINE WINGDV(AR,AREA,DIHED,FDENWG,LFLAPC,SWEEP,SWFACT,
     &TAPER,TCROOT,TCTIP,TFLAPC,WFFRAC,XWING,ZROOT,KSWEEP,OUTCOD)
      REAL LFLAPC
      INTEGER OUTCOD
      AR=5.0
      AREA=500.0
      DIHED=0.0
      FDENWG=48.62
      LFLAPC=0.12
      SWEEP=0.0
      SWFACT=1.0
      TAPER=0.99
      TCROOT=0.1
      TCTIP=0.1
      TFLAPC=0.12
      WFFRAC=1.0
```

```
      XWING=0.5
      ZROOT=0.0
      KSWEEP=0
      OUTCOD=2
      RETURN
      END
C ------------------------------------------------------------------------
      SUBROUTINE TRAJ(DVFLAG)
C ------------------------------------------------------------------------
C --- TRAJECTORY MODULE
C ------------------------------------------------------------------------
      LOGICAL DVFLAG, LENVEL
      CHARACTER ANS*6, PHASE*8, TITLE*80
      INTEGER STATUS, LIB$SPAWN, SALT, EALT, W, B, A, P
      REAL MENDUR
      DIMENSION PHASE(12), SMACH(12), EMACH(12), SALT(12), EALT(12),
     &DIST(12), TIME(12), TURNS(12), VIND(12), WKFUEL(12), M(12),
     &IP(12), IX(12), W(12), B(12), A(12), P(12)
      IF(DVFLAG.EQ..FALSE.) THEN      ! OPTION TO BYPASS TRAJECTORY
 4000   STATUS = LIB$SPAWN('CLS')
        WRITE(6,4001)
 4001   FORMAT(//
     &  7X,'DO YOU WANT TO MAKE ANY CHANGES TO THE TRAJECTORY'/
     &  7X,'MODULE ?'//7X,'(1) YES'/7X,'(2) NO'//
     &  7X,'SELECT 1 OR 2: ',$)
        READ(5,4004,ERR=4000) NUM
 4004   FORMAT(I1)
        IF((NUM.NE.1).AND.(NUM.NE.2)) GOTO 4000
        IF(NUM.EQ.1) GOTO 5007
C ---   TRANSFER TRAJECTORY DATA FROM (10) TO (7)
        REWIND(10)
 5000   READ(10,5001) ANS
 5001   FORMAT(A6)
        IF(ANS.NE.'$$$$$$') GOTO 5000
 5003   READ(10,5004) TITLE
 5004   FORMAT(A80)
        IF(TITLE(1:6).EQ.'*** AE') RETURN
        WRITE(7,5004) TITLE
        GOTO 5003
      ENDIF
 5007 IF(DVFLAG.EQ..TRUE.) THEN      ! SET TRAJECTORY DEFAULTS
        CALL TRAJDV(CRMACH,DECEL,DELHP,DELMP,DESLF,FLFAC,FRFURE,FWGMAX,
     &  HMAXP,HMINP,MENDUR,QMAX,RANGE,SMMAXP,SMMINP,TIMTO1,TIMTO2,
     &  TOL,ULTLF,WCOMBP,WFEXT,WFTRAP,WFUEL,WKF,WKLAND,XDESC,IBREG,
     &  IENDUR,IPLOT,IPSIZE,IPRINT,IPSTO1,IPSTO2,KERROR,MILCOM,MMPROP,
     &  NCODE,NCRUSE,LENVEL)
        NUMPHA=1
      ELSE
        REWIND(10)
 5008   READ(10,5001) ANS
        IF(ANS.NE.' $TRDA') GOTO 5008
C ---   WKF=WKFUEL REQUIRED DUE TO ARRAY USED FOR WKFUEL IN PHASES
        READ(10,5010)CRMACH,DECEL,DELHP,DELMP,DESLF,FLFAC,FRFURE,FWGMAX,
     &  HMAXP,HMINP,MENDUR,QMAX,RANGE,SMMAXP,SMMINP,TIMTO1,TIMTO2,
     &  TOL,ULTLF,WCOMBP,WFEXT,WFTRAP,WFUEL,WKF,WKLAND,XDESC,IBREG,
     &  IENDUR,IPLOT,IPSIZE,IPRINT,IPSTO1,IPSTO2,KERROR,MILCOM,MMPROP,
     &  NCODE,NCRUSE,LENVEL,NUMPHA
 5010   FORMAT(12X,F4.2,10X,F4.2,11X,F6.1/11X,F3.1,12X,F5.2,10X,F3.1/
     &  12X,F4.2,11X,F3.1,11X,F7.1/11X,F3.1,13X,F4.2,9X,F6.1/
     &  11X,F7.1,9X,F3.1,12X,F3.1/12X,F5.2,10X,F5.2,7X,F5.3/
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     &  11X,F5.2,11X,F5.3,9X,F7.1/12X,F6.1,8X,F8.1,8X,F6.4/
     &  12X,F4.2,10X,F5.1,10X,I1/12X,I1,13X,I1,15X,I2/
     &  12X,I1,14X,I1,14X,I1/12X,I1,14X,I1,14X,I1/
     &  11X,I1,15X,I2,13X,L1//I10)
        NPHASE=NUMPHA !NPHASE IS THE ORIGINAL NUMBER OF PHASES FROM (10)
      ENDIF
C ------------------------------------------------------------------------
C --- TRAJECTORY PAGE 1
C ------------------------------------------------------------------------
 5020 STATUS = LIB$SPAWN('CLS')
      WRITE(6,5025) CRMACH, MENDUR, DESLF, ULTLF, RANGE, QMAX, MILCOM
 5025 FORMAT(/
     &7X,'** TRAJECTORY DATA: PAGE 1 **'//
     &7X,'(1) CRUISE MACH NUMBER.........................',F4.2/
     &7X,'(2) APPROXIMATE MACH NUMBER FOR MAX ENDURANCE...',F4.2/
     &7X,'(3) DESIGN LOAD FACTOR (G"S)...................',F5.2/
     &7X,'(4) ULTIMATE LOAD FACTOR (G"S).................',F5.2/
     &7X,'(5) AIRCRAFT RANGE (NM).....................',F7.1/
     &7X,'(6) MAXIMUM DYNAMIC PRESSURE (LBS/FT2).......',F6.1/
     &7X,'(7) TAKEOFF OBSTACLE REQUIREMENT................',I1/
     &7X,'     (0 = MILITARY AIRCRAFT)'/
     &7X,'     (1 = CIVILIAN AIRCRAFT)'//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,4004,ERR=5020) NUM
      IF(NUM.EQ.0) GOTO 5150
      GOTO (5050, 5060, 5070, 5080, 5090, 5100, 5110) ,NUM
      GOTO 5020
 5050 WRITE(6,5055)
 5055 FORMAT(/7X,'ENTER AN ESTIMATE FOR THE CRUISE MACH NUMBER: ',$)
      READ(5,5056,ERR=5050) CRMACH
 5056 FORMAT(F4.2)
      IF((CRMACH.LE.0.0).OR.(CRMACH.GT.3.0)) GOTO 5050
      GOTO 5020
 5060 WRITE(6,5065)
 5065 FORMAT(/7X,'ENTER AN ESTIMATE FOR THE MACH NUMBER AT'/
     &7X,'MAX ENDURANCE: ',$)
      READ(5,5056,ERR=5060) MENDUR
      IF((MENDUR.LT.0.0).OR.(MENDUR.GT.2.0)) GOTO 5060
      GOTO 5020
 5070 WRITE(6,5075)
 5075 FORMAT(/7X,'ENTER THE DESIGN LOAD FACTOR (G"S): ',$)
      READ(5,5056,ERR=5070) DESLF
      IF((DESLF.LT.1.0).OR.(DESLF.GT.12.0)) GOTO 5070
      GOTO 5020
 5080 WRITE(6,5085)
 5085 FORMAT(/7X,'ENTER THE ULTIMATE LOAD FACTOR (G"S): ',$)
      READ(5,5086,ERR=5080) ULTLF
 5086 FORMAT(F5.2)
      IF((ULTLF.LT.1.0).OR.(ULTLF.GT.15.0)) GOTO 5080
      GOTO 5020
 5090 WRITE(6,5095)
 5095 FORMAT(/7X,'ENTER AN ESTIMATE FOR THE AIRCRAFT'/
     &7X,'MAX RANGE (NM): ',$)
      READ(5,5096,ERR=5090) RANGE
 5096 FORMAT(F7.1)
      IF(RANGE.LE.0.0) GOTO 5090
      GOTO 5020
 5100 WRITE(6,5105)
 5105 FORMAT(/7X,'ENTER THE DESIGN MAXIMUM DYNAMIC PRESSURE (LB/FT2)
     &: ',$)
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      READ(5,5106,ERR=5100) QMAX
      IF(QMAX.LE.0.0) GOTO 5100
 5106 FORMAT(F6.1)
      GOTO 5020
 5110 WRITE(6,5115)
 5115 FORMAT(/7X,'ENTER THE TAKEOFF OBSTACLE REQUIREMENT'/
     &7X,'(0 = MILITARY AIRCRAFT, 1 = CIVILIAN AIRCRAFT): ',$)
      READ(5,4004,ERR=5110) MILCOM
      IF((MILCOM.NE.0).AND.(MILCOM.NE.1)) GOTO 5110
      GOTO 5020
C -----------------------------------------------------------------------
C --- TRAJECTORY PAGE 2
C -----------------------------------------------------------------------
 5150 STATUS = LIB$SPAWN('CLS')
      WRITE(6,5155) TIMTO1, IPSTO1, TIMTO2, IPSTO2, IBREG, IENDUR
 5155 FORMAT(/
     &7X,'** TRAJECTORY PAGE 2 **'//
     &7X,'(1) AMOUNT OF TIME DURING WARM-UP AND TAXI (MIN)...',F5.2/
     &7X,'(2) POWER SETTING DURING WARM-UP AND TAXI...........',I1/
     &7X,'(3) AMOUNT OF TIME SPENT DURING TAKE-OFF (MIN).....',F5.2/
     &7X,'(4) POWER SETTING DURING TAKE-OFF...................',I1/
     &7X,'(5) BREGUET ALTITUDE SEARCH FLAG....................',I1/
     &7X,'     (0 = NO SEARCH, 1 = SEARCH FOR RANGE '/
     &7X,'    OPTIMUM ALTITUDE)'/
     &7X,'(6) LOITER ALTITUDE SEARCH FLAG.....................',I1/
     &7X,'    0 = NO SEARCH'/
     &7X,'    1 = SEARCH FOR BEST LOITER ALTITUDE'//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,4004,ERR=5150) NUM
      IF(NUM.EQ.0) GOTO 5300
      GOTO (5170, 5180, 5190, 5200, 5210, 5220) ,NUM
      GOTO 5150
 5170 WRITE(6,5175)
 5175 FORMAT(/7X,'ENTER THE AMOUNT OF TIME THAT WILL BE'/
     &7X,'SPENT DURING WARM-UP AND TAXI (MIN): ',$)
      READ(5,5086,ERR=5170) TIMTO1
      IF(TIMTO1.LE.0.0) GOTO 5170
      GOTO 5150
 5180 WRITE(6,5185)
 5185 FORMAT(/7X,'ENTER THE POWER SETTING THAT WILL BE USED'/
     &7X,'DURING WARM-UP AND TAXI.'/
     &7X,'(1 = MAX AFTERBURNER, 2 = MILITARY POWER'/
     &7X,' 3 = MAX CONTINUOUS,  4 = THRUST EQUALS DRAG'/
     &7X,' 5 = IDLE POWER): ',$)
      READ(5,4004,ERR=5180) IPSTO1
      IF((IPSTO1.LT.1).OR.(IPSTO1.GT.5)) GOTO 5180
      GOTO 5150
 5190 WRITE(6,5195)
 5195 FORMAT(/7X,'ENTER THE AMOUNT OF TIME THAT WILL BE SPENT'/
     &7X,'DURING THE TAKE-OFF (MIN): ',$)
      READ(5,5086,ERR=5190) TIMTO2
      IF(TIMTO2.LE.0.0) GOTO 5190
      GOTO 5150
 5200 WRITE(6,5205)
 5205 FORMAT(/7X,'ENTER THE POWER SETTING THAT WILL BE'/
     &7X,'USED DURING THE TAKE-OFF.'/
     &7X,'(1 = MAX AFTERBURNER, 2 = MILITARY POWER'/
     &7X,' 3 = MAX CONTINUOUS,  4 = THRUST EQUALS DRAG'/
     &7X,' 5 = IDLE POWER): ',$)
      READ(5,4004,ERR=5200) IPSTO2
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      IF((IPSTO2.LT.1).OR.(IPSTO2.GT.5)) GOTO 5200
      GOTO 5150
 5210 WRITE(6,5215)
 5215 FORMAT(/7X,'ENTER THE BREGUET ALTITUDE SEARCH FLAG. THIS'/
     &7X,'WILL ENABLE ACSYNT TO DETERMINE THE RANGE-OPTIMUM'/
     &7X,'ALTITUDE DURING THE CLIMB AND CRUISE PHASES OF THE'/
     &7X,'TRAJECTORY.  (0 = NO SEARCH, 1 = SEARCH): ',$)
      READ(5,4004,ERR=5210) IBREG
      IF((IBREG.NE.0).AND.(IBREG.NE.1)) GOTO 5210
      IBREG=0           ! DISABLED AT THIS TIME
      GOTO 5150
 5220 WRITE(6,5225)
 5225 FORMAT(/7X,'ENTER THE LOITER ALTITUDE SEARCH FLAG. THIS'/
     &7X,'WILL ENABLE ACSYNT TO DETERMINE THE TIME-OPTIMUM'/
     &7X,'ALTITUDE DURING THE LOITER PHASE (0 = NO SEARCH,'/
     &7X,'1 = SEARCH): ',$)
      READ(5,4004,ERR=5220) IENDUR
      IF((IENDUR.NE.0).AND.(IENDUR.NE.1)) GOTO 5220
      IENDUR=0      ! DISABLED AT THIS TIME
      GOTO 5150
C ---------------------------------------------------------------
C --- TRAJECTORY PAGE 3
C ---------------------------------------------------------------
 5300 STATUS = LIB$SPAWN('CLS')
      WRITE(6,5305) FRFURE, WFUEL, WFEXT, WFTRAP, IPSIZE, NCRUSE,
     &NUMPHA, IPRINT
 5305 FORMAT(/
     &7X,'** TRAJECTORY PAGE 3 **'//
     &7X,'(1) FUEL RESERVE, AS A FRACTION OF TOTAL FUEL. ....',F4.2/
     &7X,'(2) TOTAL INTERNAL FUEL (LBS)..................',F8.1/
     &7X,'(3) EXTERNAL FUEL WEIGHT (LBS).................',F7.1/
     &7X,'(4) WEIGHT OF TRAPPED FUEL (LBS)...............',F6.1/
     &7X,'(5) ENGINE SIZING FLAG...........................',I2/
     &7X,'(6) NUMBER OF TRAJECTORY CRUISE PHASES............',I2/
     &7X,'(7) TOTAL NUMBER OF TRAJECTORY PHASES.............',I2/
     &7X,'(8) DEBUG OPTION..................................',I1//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,4004,ERR=5300) NUM
      IF(NUM.EQ.0) THEN     ! WRITE $TRDATA INFO
        WRITE(7,5310) CRMACH,DECEL,DELHP,DELMP,DESLF,FLFAC,FRFURE,
     &  FWGMAX,HMAXP,HMINP,MENDUR,QMAX,RANGE,SMMAXP,SMMINP,TIMTO1,
     &  TIMTO2,TOL,ULTLF,WCOMBP,WFEXT,WFTRAP,WFUEL,WKF,WKLAND,
     &  XDESC,IBREG,IENDUR,IPLOT,IPSIZE,IPRINT,IPSTO1,IPSTO2,KERROR,
     $  MILCOM,MMPROP,NCODE,NCRUSE,LENVEL,NUMPHA
 5310   FORMAT(' $TRDATA'/5X,'CRMACH=',F4.2,',',3X,'DECEL=',F4.2,',',4X,
     &  'DELHP=',F6.1,','/5X,'DELMP=',F3.1,',',5X,'DESLF=',F5.2,',',3X,
     &  'FLFAC=',F3.1,','/5X,'FRFURE=',F4.2,',',3X,'FWGMAX=',F3.1,',',
     &  4X,'HMAXP=',F7.1,','/5X,'HMINP=',F3.1,',',5X,'MENDUR=',F4.2,',',
     &  3X,'QMAX=',F6.1,','/5X,'RANGE=',F7.1,',',1X,'SMMAXP=',F3.1,',',
     &  4X,'SMMINP=',F3.1,','/5X,'TIMTO1=',F5.2,',',2X,'TIMTO2=',F5.2,
     &  ',',2X,'TOL=',F5.3,','/5X,'ULTLF=',F5.2,',',3X,'WCOMBP=',F5.3,
     &  ',',2X,'WFEXT=',F7.1,','/5X,'WFTRAP=',F6.1,',',1X,'WFUEL=',F8.1,
     &  ',','WKFUEL=',F6.4,','/5X,'WKLAND=',F4.2,',',3X,'XDESC=',F5.1,
     &  ',',3X,'IBREG=',I1,','/5X,'IENDUR=',I1,',',6X,'IPLOT=',I1,',',
     &  7X,'IPSIZE=',I2,','/5X,'IPRINT=',I1,',',6X,'IPSTO1=',I1,',',6X,
     &  'IPSTO2=',I1,','/5X,'KERROR=',I1,',',6X,'MILCOM=',I1,',',6X,
     &  'MMPROP=',I1,','/5X,'NCODE=',I1,',',7X,'NCRUSE=',I2,',',5X,
     &  'LENVEL=',L1,','/5X,'$END'/I10)
        GOTO 5400
      ENDIF
```

```
      GOTO (5320, 5330, 5340, 5350, 5360, 5370, 5380, 5390) ,NUM
      GOTO 5300
 5320 WRITE(6,5325)
 5325 FORMAT(/7X,'ENTER THE FUEL RESERVE AS A FRACTION'/
     &7X,'OF THE TOTAL FUEL: ',$)
      READ(5,5056,ERR=5320) FRFURE
      IF((FRFURE.LT.0.0).OR.(FRFURE.GT.0.1)) GOTO 5320
      GOTO 5300
 5330 WRITE(6,5335)
 5335 FORMAT(/7X,'ENTER THE TOTAL INTERNAL FUEL (LBS): ',$)
      READ(5,5336,ERR=5330) WFUEL
 5336 FORMAT(F8.1)
      IF(WFUEL.LT.0.0) GOTO 5330
      GOTO 5300
 5340 WRITE(6,5345)
 5345 FORMAT(/7X,'ENTER THE WEIGHT OF THE EXTERNAL FUEL (LBS): ',$)
      READ(5,5096,ERR=5340) WFEXT
      IF((WFEXT.LT.0.0).OR.(WFEXT.GT.99999.0)) GOTO 5340
      GOTO 5300
 5350 WRITE(6,5355)
 5355 FORMAT(/7X,'ENTER THE WEIGHT OF THE TRAPPED FUEL (LBS).'/
     &7X,'(THIS IS THE AMOUNT OF FUEL THAT IS IN THE AIRCRAFT'/
     &7X,'BUT CANNOT BE BURNED): ',$)
      READ(5,5106,ERR=5350) WFTRAP
      IF((WFTRAP.LT.0.0).OR.(WFTRAP.GT.1000.0)) GOTO 5350
      GOTO 5300
 5360 WRITE(6,5365)
 5365 FORMAT(/7X,'ENTER THE ENGINE SIZING FLAG.'/
     &7X,'(0 = SIZED FOR T/W RATIO AT TAKE-OFF, NO AB'/
     &7X,' -1 = SIZED FOR T/W RATIO AT TAKE-OFF, WITH AB'/
     &7X,' -2 = SIZED FOR GIVEN THRUST, WITH AB'/
     &7X,' -3 = SIZED FOR GIVEN THRUST, NO AB): ',$)
      READ(5,5366,ERR=5360) IPSIZE
 5366 FORMAT(I2)
      IF((IPSIZE.LT.-3).OR.(IPSIZE.GT.0)) GOTO 5360
      GOTO 5300
 5370 WRITE(6,5375)
 5375 FORMAT(/7X,'ENTER THE NUMBER OF CRUISE PHASES THAT ARE'/
     &7X,'INCLUDED IN YOUR TRAJECTORY PROFILE: ',$)
      READ(5,5366,ERR=5370) NCRUSE
      IF((NCRUSE.GT.12).OR.(NCRUSE.LT.0)) GOTO 5370
      GOTO 5300
 5380 WRITE(6,5385)
 5385 FORMAT(/7X,'ENTER THE TOTAL NUMBER OF PHASES THAT ARE'/
     &7X,'INCLUDED IN YOUR TRAJECTORY PROFILE (12 MAX): ',$)
      READ(5,5366,ERR=5380) NUMPHA
      IF((NUMPHA.LT.1).OR.(NUMPHA.GT.12)) GOTO 5380
      GOTO 5300
 5390 WRITE(6,5395)
 5395 FORMAT(/7X,'ENTER THE DEBUG OPTION CODE'/
     &7X,'0 = NO DEBUG'/7X,'1 = DEBUG: ',$)
      READ(5,4004) IPRINT
      IF((IPRINT.NE.0).AND.(IPRINT.NE.1)) GOTO 5390
      GOTO 5300
C ---------------------------------------------------------------------
C --- INPUT THE TRAJECTORY PHASES
C ---------------------------------------------------------------------
 5400 IF(DVFLAG.EQ..FALSE.) THEN
        STATUS = LIB$SPAWN('CLS')
 5405   WRITE(6,5406)
```

```
5406    FORMAT(//
     &7X,'DO YOU WANT TO MAKE ANY CHANGES TO THE TRAJECTORY'/
     &7X,'PHASES ?  (IF YOU CHANGED THE NUMBER OF PHASES'/
     &7X,'IN THE LAST SECTION YOU MUST SELECT "YES")'//
     &7X,'(1) YES'/7X,'(2) NO'//
     &7X,'SELECT 1 OR 2: ',$)
        READ(5,5407) ANS
5407    FORMAT(A1)
        IF((ANS.NE.'1').AND.(ANS.NE.'2')) GOTO 5405
        IF(ANS.EQ.'2') THEN !TRANSFER THE OLD TRAJECTORY FROM (10)TO(7)
          REWIND(10)
5410      READ(10,5415) ANS
5415      FORMAT(5X,A6)
          IF(ANS.NE.'NCODE=') GOTO 5410
          READ(10,5420) ANS
5420      FORMAT(A1/A1)         ! MOVE THE FILE POINTER 2 LINES DOWN
          READ(10,5004) TITLE    ! MOVE THE FIRST TRAJ HEADER OVER TO (7)
          WRITE(7,5004) TITLE
          READ(10,5004) TITLE
          WRITE(7,5004) TITLE
          READ(10,5004) TITLE
          WRITE(7,5004) TITLE
          DO 5425 I=1,NPHASE    ! MOVE ALL THE PHASES OVER TO (7)
            READ(10,5004) TITLE
            WRITE(7,5004) TITLE
5425      CONTINUE
          RETURN
        ENDIF
      ENDIF
      WRITE(7,5430)
5430 FORMAT(9X,'MACH NO.   ALTITUDE     HORIZONTAL     NO.  VIND'/
     &'PHASE    START END  START  END    DIST  TIME    TURN  "G"S',
     &'  WKFUEL M IP IX W B A P'/
     &'------- ---- ----  ----- -----  ------ -----  ---- -----',
     &'  ------ - -- -- - - - -')
5435 IF(DVFLAG.EQ..TRUE.) THEN
        DO 5440 I=1,NUMPHA
          PHASE(I)='CLIMB    '
          SMACH(I)=0.0
          EMACH(I)=0.0
          SALT(I)=0
          EALT(I)=0
          DIST(I)=0.0
          TIME(I)=0.0
          TURNS(I)=0.0
          VIND(I)=0.0
          WKFUEL(I)=1.0
          M(I)=1
          IP(I)=2
          IX(I)=0
          W(I)=0
          B(I)=0
          A(I)=0
          P(I)=0
5440    CONTINUE
      ELSE
        REWIND(10)
5442    READ(10,5001,END=5447) ANS
        IF(ANS.NE.'------') GOTO 5442
        DO 5445 I=1,NPHASE
```

```
        READ(10,5460) PHASE(I), SMACH(I), EMACH(I), SALT(I),
     &  EALT(I), DIST(I), TIME(I), TURNS(I), VIND(I), WKFUEL(I),
     &  M(I), IP(I), IX(I), W(I), B(I), A(I), P(I)
5445    CONTINUE
        IF(NPHASE.LT.NUMPHA) GOTO 5447
      ENDIF
      GOTO 5449
5447  DO 5448 I=NPHASE+1,NUMPHA  ! COMES FROM EOF READ
        PHASE(I)='CLIMB   '
        SMACH(I)=0.0
        EMACH(I)=0.0
        SALT(I)=0
        EALT(I)=0
        DIST(I)=0.0
        TIME(I)=0.0
        TURNS(I)=0.0
        VIND(I)=0.0
        WKFUEL(I)=1.0
        M(I)=1
        IP(I)=2
        IX(I)=0
        W(I)=0
        B(I)=0
        A(I)=0
        P(I)=0
5448  CONTINUE
5449  DO 5700 I=1,NUMPHA
5450    STATUS = LIB$SPAWN('CLS')
        WRITE(6,5455) I, PHASE(I), SMACH(I), EMACH(I), SALT(I),
     &  EALT(I), DIST(I), TIME(I), VIND(I), IP(I), W(I), B(I), A(I)
5455    FORMAT(/
     &  7X,'** PHASE NUMBER ',I2,' **'//
     &  7X,'(1)  PHASE TYPE..................................',A8/
     &  7X,'(2)  STARTING MACH NUMBER.........................',F4.2/
     &  7X,'(3)  ENDING MACH NUMBER...........................',F4.2/
     &  7X,'(4)  STARTING ALTITUDE (FT).......................',I5/
     &  7X,'(5)  ENDING ALTITUDE (FT).........................',I5/
     &  7X,'(6)  DISTANCE COVERED DURING PHASE (NM).......',F6.1/
     &  7X,'(7)  TIME SPENT DURING PHASE (MIN).............',F5.1/
     &  7X,'(8)  LOAD FACTOR DURING COMBAT (G"S)............',F4.1/
     &  7X,'(9)  POWER SETTING DURING PHASE.................',I1/
     &  7X,'      (1=MAX AB, 2=MILITARY, 3=MAX CONTINUOUS'/
     &  7X,'       4=THRUST=DRAG, 5=IDLE)'/
     &  7X,'(10) MISSILE DROP INDICATOR (COMBAT).............',I1/
     &  7X,'(11) BOMB DROP INDICATOR (COMBAT)................',I1/
     &  7X,'(12) AMMUNITION DROP INDICATOR (COMBAT)..........',I1//
     &  7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
        READ(5,5366,ERR=5450) NUM
        IF(NUM.EQ.0) THEN
          WRITE(7,5460) PHASE(I), SMACH(I), EMACH(I), SALT(I),
     &    EALT(I), DIST(I), TIME(I), TURNS(I), VIND(I), WKFUEL(I),
     &    M(I), IP(I), IX(I), W(I), B(I), A(I), P(I)
5460      FORMAT(A8,F4.2,1X,F4.2,2X,I5,1X,I5,2X,F6.1,1X,F5.1,2X,F4.1,
     &    1X,F5.1,2X,F6.4,1X,I1,1X,I2,1X,I2,4(1X,I1))
          GOTO 5700
        ENDIF
        GOTO (5470, 5480, 5490, 5500, 5510, 5520, 5530, 5540, 5550,
     &  5560, 5570, 5580) ,NUM
        GOTO 5450
5470    WRITE(6,5475)
```

```
5475    FORMAT(/7X,'ENTER THE PHASE NAME IN CAPITAL LETTERS'/
     &  7X,'(CLIMB, ACCEL, CRUISE, LOITER, COMBAT OR DESCENT): ',$)
        READ(5,5476,ERR=5470) PHASE(I)
5476    FORMAT(A8)
        IF((PHASE(I).NE.'CLIMB   ').AND.(PHASE(I).NE.'ACCEL   ').AND.
     &  (PHASE(I).NE.'CRUISE  ').AND.(PHASE(I).NE.'LOITER  ').AND.
     &  (PHASE(I).NE.'COMBAT  ').AND.(PHASE(I).NE.'DESCENT '))
     &  GOTO 5470
        IF(PHASE(I).EQ.'CLIMB   ') THEN
          SMACH(I)=0.0
          EMACH(I)=0.0
          SALT(I)=0
          EALT(I)=20000
          DIST(I)=0.0
          TIME(I)=0.0
          IP(I)=2
          W(I)=0
          B(I)=0
          A(I)=0
        ENDIF
        IF(PHASE(I).EQ.'ACCEL   ') THEN
          SMACH(I)=0.5
          EMACH(I)=1.0
          SALT(I)=20000
          EALT(I)=20000
          DIST(I)=0.0
          TIME(I)=1.0
          IP(I)=2
          W(I)=0
          B(I)=0
          A(I)=0
        ENDIF
        IF(PHASE(I).EQ.'CRUISE  ') THEN
          SMACH(I)=0.7
          EMACH(I)=0.7
          SALT(I)=20000
          EALT(I)=20000
          DIST(I)=420.0
          TIME(I)=60.0
          IP(I)=4
          W(I)=0
          B(I)=0
          A(I)=0
        ENDIF
        IF(PHASE(I).EQ.'LOITER  ') THEN
          SMACH(I)=0.3
          EMACH(I)=0.3
          SALT(I)=500
          EALT(I)=500
          DIST(I)=0.0
          TIME(I)=30.0
          IP(I)=4
          W(I)=0
          B(I)=0
          A(I)=0
        ENDIF
        IF(PHASE(I).EQ.'COMBAT  ') THEN
          SMACH(I)=0.8
          EMACH(I)=0.8
          SALT(I)=500
```

```
          EALT(I)=500
          DIST(I)=0.0
          TIME(I)=10.0
          IP(I)=3
          W(I)=0
          B(I)=0
          A(I)=0
        ENDIF
        IF(PHASE(I).EQ.'DESCENT ') THEN
          SMACH(I)=0.5
          EMACH(I)=0.5
          SALT(I)=20000
          EALT(I)=500
          DIST(I)=0.0
          TIME(I)=0.0
          IP(I)=5
          W(I)=0
          B(I)=0
          A(I)=0
        ENDIF
        GOTO 5450
5480    WRITE(6,5485)
5485    FORMAT(/7X,'ENTER THE PHASE STARTING MACH NUMBER. '/
     &  7X,'IF THIS IS A CLIMB PHASE ENTER 0.0): ',$)
        READ(5,5056,ERR=5480) SMACH(I)
        IF(PHASE(I).EQ.'CLIMB   ') SMACH(I)=0.0
        GOTO 5450
5490    WRITE(6,5495)
5495    FORMAT(/7X,'ENTER THE ENDING MACH NUMBER FOR THE PHASE'/
     &  7X,'(ENTER 0.0 FOR CLIMB PHASE): ',$)
        READ(5,5056,ERR=5490) EMACH(I)
        IF(PHASE(I).EQ.'CLIMB   ') EMACH(I)=0.0
        GOTO 5450
5500    WRITE(6,5505)
5505    FORMAT(/7X,'ENTER THE STARTING ALTITUDE: ',$)
        READ(5,5506,ERR=5500) SALT(I)
        IF((SALT(I).LT.0).OR.(SALT(I).GT.99999)) GOTO 5500
5506    FORMAT(I5)
        GOTO 5450
5510    WRITE(6,5515)
5515    FORMAT(//7X,'ENTER THE ENDING ALTITUDE (FT) ( -1 MAY BE'/
     &  7X,'ENTERED TO PREVENT THE AIRPLANE FROM CLIMBING): ',$)
        READ(5,5506,ERR=5510) EALT(I)
        IF((EALT(I).LT.-1).OR.(EALT(I).GT.99999)) GOTO 5510
        IF((EALT(I).EQ.-1).AND.(PHASE(I).EQ.'CLIMB   ')) GOTO 5510
        GOTO 5450
5520    WRITE(6,5525)
5525    FORMAT(/7X,'ENTER THE DISTANCE COVERED DURING THE'/
     &  7X,'PHASE (NM) (ENTER 0.0 FOR CLIMB/ACCEL PHASES): ',$)
        READ(5,5106,ERR=5520) DIST(I)
        IF(DIST(I).LT.0.0) GOTO 5520
        IF((PHASE(I).NE.'CRUISE  ').AND.(PHASE(I).NE.'LOITER  '))
     &  DIST(I)=0.0
        GOTO 5450
5530    WRITE(6,5535)
5535    FORMAT(/7X,'ENTER THE AMOUNT OF TIME SPENT ON THIS'/
     &  7X,'PHASE (MIN) (ENTER 0.0 FOR CLIMB/ACCEL PHASES): ',$)
        READ(5,5536,ERR=5530) TIME(I)
5536    FORMAT(F5.1)
        IF(TIME(I).LT.0.0) GOTO 5530
```

```
      IF((TIME(I).EQ.0.0).AND.(PHASE(I).EQ.'ACCEL   ')) GOTO 5530
      GOTO 5450
5540  WRITE(6,5545)
5545  FORMAT(/7X,'ENTER THE LOAD FACTOR (G"S): ',$)
      READ(5,5536,ERR=5540) VIND(I)
      IF(PHASE(I).NE.'COMBAT  ') VIND(I)=0.0
      GOTO 5450
5550  WRITE(6,5555)
5555  FORMAT(/7X,'ENTER THE PHASE POWER SETTING'/
     & 7X,'1 = MAX AFTERBURNER'/7X,'2 = MILITARY POWER'/
     & 7X,'3 = MAX CONTINUOUS POWER'/7X,'4 = THRUST EQUALS DRAG
     & '/7X,'5 = IDLE POWER: ',$)
      READ(5,5366,ERR=5550) IP(I)
      IF((IP(I).LT.1).OR.(IP(I).GT.5)) GOTO 5550
      GOTO 5450
5560  WRITE(6,5565)
5565  FORMAT(/7X,'MISSILE DROP INDICATOR (COMBAT PHASE ONLY)'/
     & 7X,'0 = NO DROP'/7X,'1 = DROP AT END OF PHASE: ',$)
      READ(5,4004,ERR=5560) W(I)
      IF((W(I).NE.0).AND.(W(I).NE.1)) GOTO 5560
      IF(PHASE(I).NE.'COMBAT  ') W(I)=0
      GOTO 5450
5570  WRITE(6,5575)
5575  FORMAT(/7X,'BOMB DROP INDICATOR (COMBAT PHASE ONLY)'/
     & 7X,'0 = NO DROP'/7X,'1 = DROP AT END OF PHASE: ',$)
      READ(5,4004,ERR=5570) B(I)
      IF((B(I).NE.0).AND.(B(I).NE.1)) GOTO 5570
      IF(PHASE(I).NE.'COMBAT  ') B(I)=0
      GOTO 5450
5580  WRITE(6,5585)
5585  FORMAT(/7X,'AMMUNITION DROP INDICATOR (COMBAT PHASE ONLY)'/
     & 7X,'0 = NO DROP'/7X,'1 = DROP AT END OF PHASE: ',$)
      READ(5,4004,ERR=5580) A(I)
      IF((A(I).NE.0).AND.(A(I).NE.1)) GOTO 5580
      IF(PHASE(I).NE.'COMBAT  ') A(I)=0
      GOTO 5450
5700 CONTINUE
     RETURN
     END
C ---------------------------------------------------------------------
C --- TRAJECTORY DEFAULTS
C ---------------------------------------------------------------------
     SUBROUTINE TRAJDV(CRMACH,DECEL,DELHP,DELMP,DESLF,FLFAC,FRFURE,
    &FWGMAX,HMAXP,HMINP,MENDUR,QMAX,RANGE,SMMAXP,SMMINP,TIMTO1,TIMTO2,
    &TOL,ULTLF,WCOMBP,WFEXT,WFTRAP,WFUEL,WKF,WKLAND,XDESC,IBREG,
    &IENDUR,IPLOT,IPSIZE,IPRINT,IPSTO1,IPSTO2,KERROR,MILCOM,MMPROP,
    &NCODE,NCRUSE,LENVEL)
     REAL MENDUR
     LOGICAL LENVEL
     CRMACH=0.8
     DECEL=0.25
     DELHP=4000.0
     DELMP=0.1
     DESLF=3.0
     FLFAC=0.6
     FRFURE=0.05
     FWGMAX=1.2
     HMAXP=40000.0
     HMINP=0.0
     MENDUR=0.5
```

```
      QMAX=700.0
      RANGE=1000.0
      SMMAXP=0.9
      SMMINP=0.3
      TIMTO1=5.0
      TIMTO2=1.0
      TOL=0.001
      ULTLF=4.5
      WCOMBP=0.5
      WFEXT=0.0
      WFTRAP=100.0
      WFUEL=5000.0
      WKF=1.000
      WKLAND=0.57
      XDESC=80.0
      IBREG=0
      IENDUR=0
      IPLOT=0
      IPSIZE=-3
      IPRINT=0
      IPSTO1=5
      IPSTO2=2
      KERROR=2
      MILCOM=0
      MMPROP=1
      NCODE=0
      NCRUSE=2
      LENVEL=.FALSE.
      RETURN
      END
C ====================================================================
      SUBROUTINE AERO(DVFLAG,NVFLAG)
C ----------------------------------------------------------------
C --- AERODYNAMICS SECTION
C ----------------------------------------------------------------
      LOGICAL DVFLAG, ELLIPC, ELLIPW, ELLIPH
      INTEGER STATUS, LIB$SPAWN, AJCAN, ALELJ, EN
      DIMENSION CLO(10), CLOC(10), CLOW(10), CMO(10), YSWP(10),
     &FCDRA(10), FLDM(10), FVCAM(10), ALTV(10), CLINPT(10),
     &CDBMB(10), CDONPT(10), CDSTR(10), CDTNK(10), CDEXTR(10),
     &SMNCDO(10), SMNBMB(10), SMSTRS(10), SMTANK(10), SMEXTR(10),
     &ITRIM(10), ALIN(10), SMN(10), SMNSWP(10), ALTD(6), XMACH(6)
      REAL MACHN, IT, LDLAND, LDTO, MACH1, MACH2
      CHARACTER ANS*6, TITLE*80
   10 FORMAT(I1)
   20 FORMAT(A6)
   30 FORMAT(A80)
 5710 IF(DVFLAG.EQ..FALSE.) THEN            ! OPTION TO BYPASS AERO
 5711   STATUS = LIB$SPAWN('CLS')
        WRITE(6,5712)
 5712   FORMAT(/
     &  7X,'DO YOU WANT TO MAKE ANY CHANGES TO THE AERODYNAMICS'/
     &  7X,'MODULE ?'//7X,'(1) YES'/7X,'(2) NO'//
     &  7X,'SELECT 1 OR 2: ',$)
        READ(5,10,ERR=5711) NUM
        IF((NUM.NE.1).AND.(NUM.NE.2)) GOTO 5711
        IF(NUM.EQ.1) GOTO 5718
C ---   TRANSFER AERO DATA FROM (10) TO (7)
        REWIND(10)
 5713   READ(10,20) ANS
```

```
      IF(ANS.NE.'*** AE') GOTO 5713
      WRITE(7,5719)
 5714 READ(10,30) TITLE
      IF(TITLE(1:6).EQ.'*** PR') RETURN
      WRITE(7,30) TITLE
      GOTO 5714
    ENDIF
 5718 WRITE(7,5719)
 5719 FORMAT('*** AERODYNAMICS DATA ***')
C --- SET ALL AERO DEFAULTS/GET OLD VALUES FIRST (FOR EACH NAMELIST)
C --- THEN SET UP NAMELIST MENUS.
    IF(DVFLAG.EQ..TRUE.) THEN    ! SET AERO DEFAULTS
      DO 5720 I=1,10
        CLO(I)=0.0
        CLOC(I)=0.0
        CLOW(I)=0.0
        CMO(I)=0.0
        YSWP(I)=0.0
        FCDRA(I)=1.0
        FLDM(I)=1.0
        FVCAM(I)=1.0
        ALTV(I)=0.0
        CLINPT(I)=0.0
        CDBMB(I)=0.0
        CDONPT(I)=0.0
        CDSTR(I)=0.0
        CDTNK(I)=0.0
        CDEXTR(I)=0.0
        SMNCDO(I)=0.0
        SMNBMB(I)=0.0
        SMSTRS(I)=0.0
        SMTANK(I)=0.0
        SMEXTR(I)=0.0
        ITRIM(I)=0
        SMN(I)=0.0
 5720 CONTINUE
      ABOSB=0.15
      ALIN(1)=0.0
      ALIN(2)=3.0
      ALIN(3)=6.0
      ALIN(5)=9.0
      ALIN(6)=12.0
      ALIN(7)=15.0
      ALIN(8)=18.0
      ALIN(9)=21.0
      ALIN(10)=24.0
      ALMAX=35.0
      AMC=40.0
      BDNOSE=BDMAX
      BTEF=0.0
      MACHN=0.75
      RCLMAX=1.0
      ROC=0.02
      ROCAN=0.02
      SFWF=1.0
      SPANAC=0.0
      SWPMAX=60.0
      SWPMIN=0.0
      AJCAN=1
      ALELJ=1
```

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      INORM=1
      ISMNDR=0
      ISUPCR=0
      ITRAP=0
      CSF=0.0
      ESSF=1.0
      FCDF=1.0
      FCDL=1.0
      CAND=0.0
      CGM=0.25
      IT=0.0
      SFLAP=0.0
      SM=0.0
      SPANF=0.0
      ZCG=0.0
      IVCAM=1
      ICOD=1
      IPLOT=1
      NALF=10
      NMDTL=1
      CLLAND=-1.0
      CLTO=-1.0
      DELFLD=45.0
      DELFTO=45.0
      DELLED=30.0
      DELLTO=30.0
      LDLAND=-1.0
      LDTO=-1.0
      ELLIPC=.FALSE.
      ELLIPH=.FALSE.
      ELLIPW=.FALSE.
    ELSE
      REWIND(10)
5730  READ(10,20) ANS
      IF(ANS.NE.' $ACHA') GOTO 5730
      READ(10,5740) ABOSB, ALMAX, AMC, BDNOSE, BTEF, (CLO(I),I=1,10),
   &  (CLOC(I),I=1,10), (CLOW(I),I=1,10), (CMO(I),I=1,10), MACHN,
   &  RCLMAX, ROC, ROCAN, SFWF, SMNDR, (SMNSWP(I),I=1,10), SPANAC,
   &  SWPMAX, SWPMIN, (YSWP(I),I=1,10), AJCAN, ALELJ, INORM, ISMNDR,
   &  ISUPCR, ITRAP, ELLIPC, ELLIPH, ELLIPW, CSF, ESSF, FCDF, CAND,
   &  CFLAP, CGM, (FLDM(I),I=1,10), (FVCAM(I),I=1,10), IT, SFLAP,
   &  SM, SPANF, ZCG, IVCAM, ITRIM, (ALIN(I),I=1,10),
   &  (ALTV(I),I=1,10), (CLINPT(I),I=1,10), (SMN(I),I=1,10),
   &  ICOD, IPLOT, NALF, NMDTL, (CDBMB(I),I=1,10), (CDSTR(I),I=1,10),
   &  (CDTNK(I),I=1,10), (CDEXTR(I),I=1,10), (SMNBMB(I),I=1,10),
   &  (SMSTRS(I),I=1,10), (SMTANK(I),I=1,10), (SMEXTR(I),I=1,10),
   &  ICDO, CLLAND, CLTO, DELFLD, DELFTO, DELLED, DELLTO, LDLAND,
   &  LDTO
5740  FORMAT(11X,F6.3,9X,F6.3,7X,F6.3/12X,F6.3,7X,F5.3/9X,10(F5.3,1X)/
   &  10X,10(F5.3,1X)/10X,10(F5.3,1X)/9X,10(F5.3,1X)
   &  /11X,F6.3,10X,F6.3,6X,F5.3/
   &  11X,F5.3,9X,F5.3,11X,F5.3/12X,10(F5.3,1X)/
   &  12X,F6.3,9X,F6.3,9X,F6.3/
   &  10X,10(F6.3,1X)/11X,I1,14X,I1,14X,I1/12X,I1,14X,I1,13X,I1/
   &  12X,L1,14X,L1,14X,L1///
   &  9X,F5.3,11X,F5.3,10X,F5.2///10X,F6.3,10X,F6.3,7X,F5.3/
   &  10X,10(F6.3,1X)/11X,10(F6.3,1X)/8X,F6.3,12X,F7.2,5X,F6.3/
   &  11X,F6.2,7X,F5.2,12X,I1/11X,10(I1,1X)///10X,10(F4.1,1X)/
   &  10X,10(F6.0,1X)/
   &  12X,10(F6.3,1X)/9X,10(F5.3,1X)/10X,I1,15X,I1,13X,I2/11X,I2///
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     &  11X,10(F6.3,1X)/11X,10(F6.3,1X)/11X,10(F6.3,1X)/
     &  12X,10(F6.3,1X)/12X,10(F5.3,1X)/
     &  12X,10(F5.3,1X)/12X,10(F5.3,1X)/12X,10(F5.3,1X)/
     &  10X,I1///12X,F6.3,7X,F6.3,
     &  11X,F6.3/12X,F6.3,9X,F6.3,9X,F6.3/12X,F6.3,7X,F6.3)
      ENDIF
C ---------------------------------------------------------------------
C --- AERO PAGE 1
C ---------------------------------------------------------------------
 5760 STATUS = LIB$SPAWN('CLS')
      WRITE(6,5765) ABOSB, ALMAX, AMC, BDNOSE, BTEF, RCLMAX, SFWF
 5765 FORMAT(/
     &7X,'** AERO PAGE 1 **'//
     &7X,'(1) RATIO OF BODY BASE AREA TO MAXIMUM BODY AREA..',F6.3/
     &7X,'(2) ANGLE OF ATTACK FOR CLMAX (DEGREES)...........',F6.3/
     &7X,'(3) MAXIMUM ANGLE OF ATTACK (DEGREES).............',F6.3/
     &7X,'(4) WIDTH OF THE FUSELAGE AT THE NOSE (OR AT THE'/
     &7X,'    CANARDS IF PRESENT) (FEET)....................',F6.3/
     &7X,'(5) BOAT-TAIL EXPOSURE FACTOR......................',F5.3/
     &7X,'(6) CLMAX SCALING FACTOR FOR USE WITH FLAPS.......',F6.3/
     &7X,'(7) LAMINAR-TURBULENT WEIGHTING FACTOR.............',F5.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=5760) NUM
      IF(NUM.EQ.0) GOTO 5860
      GOTO (5770, 5780, 5790, 5800, 5810, 5820, 5830) ,NUM
      GOTO 5760
 5770 WRITE(6,5775)
 5775 FORMAT(/7X,'ENTER THE RATIO OF THE BODY BASE AREA TO THE'/
     &7X,'MAXIMUM BODY AREA: ',$)
      READ(5,5776,ERR=5770) ABOSB
 5776 FORMAT(F6.3)
      IF((ABOSB.GT.0.5).OR.(ABOSB.LT.0.0)) GOTO 5770
      GOTO 5760
 5780 WRITE(6,5785)
 5785 FORMAT(/7X,'ENTER THE ANGLE OF ATTACK AT WHICH'/
     &7X,'CLMAX OCCURS (DEGREES): ',$)
      READ(5,5776, ERR=5780) ALMAX
      IF((ALMAX.LE.0.0).OR.(ALMAX.GT.60.0)) GOTO 5780
      GOTO 5760
 5790 WRITE(6,5795)
 5795 FORMAT(/7X,'ENTER THE MAXIMUM ANGLE OF ATTACK (DEGREES): ',$)
      READ(5,5776, ERR=5790) AMC
      IF((AMC.LE.0.0).OR.(AMC.GT.60.0)) GOTO 5790
      GOTO 5760
 5800 WRITE(6,5805)
 5805 FORMAT(/7X,'ENTER THE WIDTH OF THE FUSELAGE AT THE NOSE OR'/
     &7X,'AT THE CANARD LOCATION (IF IT EXISTS) (FEET): ',$)
      READ(5,5776,ERR=5800) BDNOSE
      IF(BDNOSE.LE.0.0) GOTO 5800
      GOTO 5760
 5810 WRITE(6,5815)
 5815 FORMAT(/7X,'ENTER THE BOAT TAIL EXPOSURE FACTOR (FOR WING OR'/
     &7X,'FUSELAGE PODS ONLY). (IF THERE ARE 3 PODS WITH ONE OF'/
     &7X,'THEM INTERNAL TO THE FUSELAGE, THEN THE BOAT TAIL'/
     &7X,'EXPOSURE FACTOR IS .667): ',$)
      READ(5,5816,ERR=5810) BTEF
 5816 FORMAT(F5.3)
      IF((BTEF.LT.0.0).OR.(BTEF.GT.1.0)) GOTO 5810
      GOTO 5760
 5820 WRITE(6,5825)
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 5825 FORMAT(/7X,'ENTER THE CLMAX SCALE FACTOR FOR USE WITH'/
     &7X,'FLAPS: ',$)
      READ(5,5776,ERR=5820) RCLMAX
      IF(RCLMAX.LE.0.0) GOTO 5820
      GOTO 5760
 5830 WRITE(6,5835)
 5835 FORMAT(/7X,'ENTER THE LAMINAR-TURBULENT SKIN FRICTION'/
     &7X,'WEIGHTING FACTOR: ',$)
      READ(5,5816,ERR=5830) SFWF
      IF((SFWF.GT.1.0).OR.(SFWF.LT.0.0)) GOTO 5830
      GOTO 5760
C -----------------------------------------------------------------
C --- AERO PAGE 2
C -----------------------------------------------------------------
 5860 STATUS = LIB$SPAWN('CLS')
      WRITE(6,5865) (SMNSWP(I),I=1,10), (CLO(I),I=1,10),
     &(CLOC(I),I=1,10), (CLOW(I),I=1,10), (CMO(I),I=1,10),
     &(YSWP(I),I=1,10)
 5865 FORMAT(/
     &7X,'** AERO PAGE 2 **'//
     &7X,'(1) REFERENCE MACH NUMBER ARRAY: ',2(F5.3,',')/
     &         11X,7(F5.3,','),F5.3//
     &7X,'(2) CL AT ZERO AOA FOR BODY: ',2(F5.3,',')/
     &         11X,7(F5.3,','),F5.3//
     &7X,'(3) CANARD CL AT ZERO AOA: ',2(F5.3,',')/
     &         11X,7(F5.3,','),F5.3//
     &7X,'(4) WING CL AT ZERO AOA: ',2(F5.3,',')/
     &         11X,7(F5.3,','),F5.3//
     &7X,'(5) ZERO LIFT PITCHING MOMENT: ',2(F5.3,',')/
     &         11X,7(F5.3,','),F5.3//
     &7X,'(6) WING SWEEP ANGLES (VARIABLE SWEEP ONLY): ',
     &         2(F6.3,',')/11X,7(F6.3,','),F6.3///
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=5860) NUM
      IF(NUM.EQ.0) GOTO 5940
      GOTO (5880, 5890, 5900, 5910, 5920, 5930) ,NUM
      GOTO5860
 5880 WRITE(6,5885)
 5885 FORMAT(/7X,'ENTER THE REFERENCE MACH NUMBER ARRAY. PUT A ","'/
     &7X,'BETWEEN EACH NUMBER. (MAXIMUM OF TEN NUMBERS).'/
     &' ENTER: ',$)
      READ(5,5886,ERR=5880) (SMNSWP(I),I=1,10)
 5886 FORMAT(10F6.3)
      DO 5887 I=1,10
        IF((SMNSWP(I).LT.0.0).OR.(SMNSWP(I).GT.3.0)) GOTO 5880
 5887 CONTINUE
      GOTO 5860
 5890 WRITE(6,5895)
 5895 FORMAT(/7X,'ENTER THE ARRAY FOR THE BODY CL AT ZERO AOA. PUT'/
     &7X,'A "," BETWEEN EACH NUMBER. (MAXIMUM OF TEN NUMBERS).'/
     &' ENTER: ',$)
      READ(5,5886,ERR=5890) (CLO(I),I=1,10)
      DO 5896 I=1,10
        IF((CLO(I).LT.0.0).OR.(CLO(I).GT.1.0)) GOTO 5890
 5896 CONTINUE
      GOTO 5860
 5900 WRITE(6,5905)
 5905 FORMAT(/7X,'ENTER THE ARRAY FOR THE CANARD CL AT ZERO AOA.'/
     &7X,'PUT A "," BETWEEN EACH NUMBER. (MAXIMUM OF TEN NUMBERS).'/
     &' ENTER: ',$)
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      READ(5,5886,ERR=5900) (CLOC(I),I=1,10)
      DO 5906 I=1,10
        IF((CLOC(I).LT.0.0).OR.(CLOC(I).GT.1.0)) GOTO 5900
 5906 CONTINUE
      GOTO 5860
 5910 WRITE(6,5915)
 5915 FORMAT(/7X,'ENTER THE ARRAY FOR THE WING CL AT ZERO AOA. PUT'/
     &7X,'A ","  BETWEEN EACH NUMBER. (MAXIMUM OF TEN NUMBERS).'/
     &' ENTER: ',$)
      READ(5,5886,ERR=5910) (CLOW(I),I=1,10)
      DO 5916 I=1,10
        IF((CLOW(I).LT.0.0).OR.(CLOW(I).GT.1.0)) GOTO 5910
 5916 CONTINUE
      GOTO 5860
 5920 WRITE(6,5925)
 5925 FORMAT(/7X,'ENTER THE ARRAY FOR THE ZERO LIFT PITCHING'/
     &7X,'MOMENT. PUT A "," BETWEEN EACH NUMBER. (MAXIMUM OF'/
     &7X,'TEN NUMBERS).'/' ENTER: ',$)
      READ(5,5886,ERR=5920) (CMO(I),I=1,10)
      DO 5926 I=1,10
        IF((CMO(I).LT.0.0).OR.(CMO(I).GT.1.0)) GOTO 5920
 5926 CONTINUE
      GOTO 5860
 5930 WRITE(6,5935)
 5935 FORMAT(/7X,'ENTER THE ARRAY FOR THE SWEEP ANGLES FOR A'/
     &7X,'VARIABLE SWEEP WING. PUT A "," BETWEEN EACH NUMBER.'/
     &7X,'(MAXIMUM OF TEN NUMBERS).'/' ENTER: ',$)
      READ(5,5936,ERR=5930) (YSWP(I),I=1,10)
 5936 FORMAT(10F7.3)
      DO 5937 I=1,10
        IF((YSWP(I).LT.0.0).OR.(YSWP(I).GT.60.0)) GOTO 5930
 5937 CONTINUE
      GOTO 5860
C ---------------------------------------------------------------
C --- AERO PAGE 3
C----------------------------------------------------------------
 5940 STATUS = LIB$SPAWN('CLS')
      WRITE(6,5945) ELLIPW, INORM, MACHN, SWPMAX, SWPMIN
 5945 FORMAT(/
     &7X,'** AERO PAGE 3 (VARIABLE SWEEP & OBLIQUE WINGS) **'//
     &7X,'(1) VARIABLE WING SWEEP FLAG.......................',L1/
     &7X,'     (T = WING IS VARIABLE SWEEP)'/
     &7X,'     (F = WING IS NOT VARIABLE SWEEP)'/
     &7X,'(2) NORMAL COMPONENT MACH NUMBER CODE..............',I1/
     &7X,'     (0 = SWEEP WING TO KEEP NORMAL COMPONENT CONST)'/
     &7X,'     (1 = DO NOT CALULATE NORMAL COMPONENT)'/
     &7X,'(3) DESIRED NORMAL COMPONENT OF MACH NUMBER.......',F6.3/
     &7X,'(4) MAXIMUM SWEEP FOR NORMAL COMPONENT MACH NUMBER'/
     &7X,'     CALCULATIONS (DEGREES).......................',F6.3/
     &7X,'(5) MINIMUM SWEEP FOR NORMAL COMPONENT MACH NUMBER'/
     &7X,'     CALCULATIONS (DEGREES).......................',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=5940) NUM
      IF(NUM.EQ.0) GOTO 6050
      GOTO (5960, 5970, 5980, 5990, 6000) ,NUM
      GOTO 5940
 5960 WRITE(6,5965)
 5965 FORMAT(/7X,'ENTER THE VARIABLE WING SWEEP FLAG: ',$)
      READ(5,5967,ERR=5960) ELLIPW
 5967 FORMAT(L1)
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      GOTO 5940
 5970 WRITE(6,5975)
 5975 FORMAT(/7X,'ENTER THE NORMAL COMPONENT MACH NUMBER'/
     &7X,'CALCULATION CODE'/
     &7X,'(0 = ACSYNT WILL SWEEP THE WING TO KEEP THE NORMAL'/
     &7X,'     COMPONENT OF THE MACH NUMBER CONSTANT)'/
     &7X,'(1 = DO NOT CALCULATE THE NORMAL COMPONENT OF THE MACH'/
     &7X,'     NUMBER): ',$)
      READ(5,10,ERR=5970) INORM
      IF((INORM.NE.0).AND.(INORM.NE.1)) GOTO 5970
      GOTO 5940
 5980 WRITE(6,5985)
 5985 FORMAT(/7X,'ENTER THE DESIRED NORMAL COMPONENT OF THE MACH'/
     &7X,'NUMBER: ',$)
      READ(5,5776,ERR=5980) MACHN
      IF((MACHN.LE.0.0).OR.(MACHN.GT.3.0)) GOTO 5980
      GOTO 5940
 5990 WRITE(6,5995)
 5995 FORMAT(/7X,'ENTER THE MAXIMUM ALLOWABLE SWEEP FOR THE NORMAL'/
     &7X,'COMPONENT CALCULATIONS (DEGREES): ',$)
      READ(5,5776,ERR=5990) SWPMAX
      IF((SWPMAX.LT.0.0).OR.(SWPMAX.GT.60.0)) GOTO 5990
      GOTO 5940
 6000 WRITE(6,6005)
 6005 FORMAT(/7X,'ENTER THE MINIMUM ALLOWABLE WING SWEEP FOR THE'/
     &7X,'NORMAL COMPONENT CALCULATIONS (DEGREES): ',$)
      READ(5,5776,ERR=6000) SWPMIN
      IF((SWPMIN.LT.0.0).OR.(SWPMIN.GT.60.0)) GOTO 6000
      GOTO 5940
C-----------------------------------------------------------------------
C --- AERO PAGE 4
C-----------------------------------------------------------------------
 6050 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6055) ALELJ, ROC, AJCAN, ROCAN, SPANAC, ISUPCR, ITRAP
 6055 FORMAT(/
     &7X,'** AERO PAGE 4 **'//
     &7X,'(1) WING AIRFOIL SECTION CODE....................',I1/
     &7X,'(2) WING LEADING EDGE RADIUS/CHORD RATIO.........',F5.3/
     &7X,'    (FOR WING AIRFOIL SECTION CODE 5 ONLY)'/
     &7X,'(3) CANARD AIRFOIL SECTION CODE..................',I1/
     &7X,'(4) CANARD LEADING EDGE RADIUS/CHORD RATIO.......',F5.3/
     &7X,'    (FOR CANARD AIRFOIL SECTION CODE 5 ONLY)'/
     &7X,'(5) DISTANCE BETWEEN THE TWIN NACELLES (FEET)...',F6.3/
     &7X,'    (USED FOR CANARD PLACEMENT)'/
     &7X,'(6) SUPERCRITICAL WING FLAG.....................',I1/
     &7X,'    (1 = WING IS SUPERCRITICAL)'/
     &7X,'    (0 = WING IS NOT SUPERCRITICAL)'/
     &7X,'(7) BODY CROSS-SECTION CODE.....................',I1/
     &7X,'    (0 = CIRCULAR BODY)'/
     &7X,'    (1 = TRAPEZOIDAL BODY)'//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=6050) NUM
      IF(NUM.EQ.0) GOTO 6150
      GOTO (6070, 6080, 6090, 6100, 6110, 6120, 6130) ,NUM
      GOTO 6050
 6070 WRITE(6,6075)
 6075 FORMAT(/7X,'ENTER THE WING AIRFOIL SECTION CODE'/
     &7X,'(1 = SHARP/NEAR SHARP AIRFOIL)'/
     &7X,'(2 = 230-XX AND 00-XX AIRFOILS)'/
     &7X,'(3 = 6-SERIES AIRFOIL)'/
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     &7X,'(4 = WHITCOMB SUPERCRITICAL AIRFOIL('/
     &7X,'(5 = LEADING EDGE RADIUS/CHORD RATIO SPECIFIED): ',$)
      READ(5,10,ERR=6070) ALELJ
      IF((ALELJ.LT.1).OR.(ALELJ.GT.5)) GOTO 6070
      GOTO 6050
 6080 WRITE(6,6085)
 6085 FORMAT(/7X,'ENTER THE WING LEADING EDGE RADIUS/CHORD RATIO: ',
     &$)
      READ(5,5816,ERR=6080) ROC
      IF((ROC.LE.0.0).OR.(ROC.GT.0.5)) GOTO 6080
      GOTO 6050
 6090 WRITE(6,6095)
 6095 FORMAT(/7X,'ENTER THE CANARD AIRFOIL SECTION CODE'/
     &7X,'(1 = SHARP/NEAR SHARP AIRFOIL)'/
     &7X,'(2 = 230-XX AND 00-XX AIRFOILS)'/
     &7X,'(3 = 6-SERIES AIRFOIL)'/
     &7X,'(4 = WHITCOMB SUPERCRITICAL AIRFOIL('/
     &7X,'(5 = LEADING EDGE RADIUS/CHORD RATIO SPECIFIED): ',$)
      READ(5,10,ERR=6090) AJCAN
      IF((AJCAN.LT.1).OR.(AJCAN.GT.5)) GOTO 6090
      GOTO 6050
 6100 WRITE(6,6105)
 6105 FORMAT(/7X,'ENTER THE CANARD LEADING EDGE RADIUS/CHORD'/
     &7X,'RATIO: ',$)
      READ(5,5816,ERR=6100) ROCAN
      IF((ROCAN.LE.0.0).OR.(ROCAN.GT.0.5)) GOTO 6080
      GOTO 6050
 6110 WRITE(6,6115)
 6115 FORMAT(/7X,'ENTER THE DISTANCE BETWEEN THE OUTSIDES OF THE'/
     &7X,'OF THE TWIN NACELLES THAT THE CANARDS ARE MOUNTED ON.'/
     &7X,'(IF APPLICABLE) (FEET): ',$)
      READ(5,5776,ERR=6110) SPANAC
      IF(SPANAC.LT.0.0) GOTO 6110
      GOTO 6050
 6120 WRITE(6,6125)
 6125 FORMAT(/7X,'ENTER THE SUPERCRITICAL WING FLAG.'/
     &7X,'(0 = WING IS NOT SUPERCRITICAL)'/
     &7X,'(1 = WING IS SUPERCRITICAL): ',$)
      READ(5,10,ERR=6120) ISUPCR
      IF((ISUPCR.NE.0).AND.(ISUPCR.NE.1)) GOTO 6120
      GOTO 6050
 6130 WRITE(6,6135)
 6135 FORMAT(/7X,'ENTER THE BODY CROSS-SECTION CODE.'/
     &7X,'(0 = CIRCULAR BODY)'/
     &7X,'(1 = TRAPEZOIDAL BODY): ',$)
      READ(5,10,ERR=6130) ITRAP
      IF((ITRAP.NE.0).AND.(ITRAP.NE.1)) GOTO 6130
      GOTO 6050
C -----------------------------------------------------------------
C --- AERO PAGE 5
C -----------------------------------------------------------------
 6150 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6155) CSF, FCDF, CAND, CFLAP, SFLAP, SPANF, CGM, SM, ZCG,
     &IT
 6155 FORMAT(/
     &7X,'** AERO PAGE 5 **'//
     &7X,'(1)  POD COWL EXPOSURE FACTOR.....................',F5.3/
     &7X,'(2)  FRICTION DRAG MULTIPLYING FACTOR............',F5.2/
     &7X,'(3)  CANARD INCIDENCE (DEGREES)..................',F6.3/
     &7X,'(4)  AVERAGE FLAP CHORD (FEET)...................',F6.3/
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     &7X,'(5)  TOTAL AREA OF BOTH WING FLAPS (FT2).......',F7.2/
     &7X,'(6)  TOTAL SPAN OF FLAPS FOR TRIMMING (FEET)....',F6.2/
     &7X,'(7)  DESIRED LOCATION OF CG (GIVEN AS A FRACTION'/
     &7X,'     OF WING CHORD).............................',F5.3/
     &7X,'(8)  STATIC MARGIN FACTOR FOR CG................',F6.3/
     &7X,'(9)  HEIGHT OF CG ABOVE THE FUSELAGE CENTERLINE'/
     &7X,'     (FEET).....................................',F5.2/
     &7X,'(10) HORIZONTAL TAIL INCIDENCE (DEGREES).........',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6160,ERR=6150) NUM
6160  FORMAT(I2)
      IF(NUM.EQ.0) GOTO 6280
      GOTO (6170, 6180, 6190, 6200, 6210, 6220, 6230, 6240, 6250,
     &6260), NUM
      GOTO 6150
6170  WRITE(6,6175)
6175  FORMAT(/7X,'ENTER THE POD COWL EXPOSURE FACTOR. (IF THERE '/
     &7X,'ARE 3 PODS ON THE DESIGN BUT ONE OF THEM IS FULLY BURIED'/
     &7X,'THEN THE EXPOSURE FACTOR IS .667): ',$)
      READ(5,5816,ERR=6170) CSF
      IF((CSF.LT.0.0).OR.(CSF.GT.1.0)) GOTO 6170
      ESSF=CSF
      GOTO 6150
6180  WRITE(6,6185)
6185  FORMAT(/7X,'ENTER THE FRICTION DRAG MULTIPLYING FACTOR.'/
     &7X,'(1.0 = STANDARD SURFACE ROUGHNESS): ',$)
      READ(5,6186,ERR=6180) FCDF
6186  FORMAT(F5.2)
      IF((FCDF.LT.0.0).OR.(FCDF.GT.2.0)) GOTO 6180
      GOTO 6150
6190  WRITE(6,6195)
6195  FORMAT(/7X,'ENTER THE CANARD ANGLE OF INCIDENCE (DEGREES): ',
     &$)
      READ(5,5776,ERR=6190) CAND
      IF((CAND.LT.0.0).OR.(CAND.GT.10.0)) GOTO 6190
      GOTO 6150
6200  WRITE(6,6205)
6205  FORMAT(/7X,'ENTER THE AVERAGE FLAP CHORD (FEET): ',$)
      READ(5,5776,ERR=6200) CFLAP
      IF(CFLAP.LT.0.0) GOTO 6200
      GOTO 6150
6210  WRITE(6,6215)
6215  FORMAT(/7X,'ENTER THE TOTAL AREA OF THE WING FLAPS (FT2): ',$)
      READ(5,6216,ERR=6210) SFLAP
6216  FORMAT(F7.2)
      IF(SFLAP.LT.0.0) GOTO 6210
      GOTO 6150
6220  WRITE(6,6225)
6225  FORMAT(/7X,'ENTER THE TOTAL SPAN OF THE FLAPS (FEET): ',$)
      READ(5,6226,ERR=6220) SPANF
6226  FORMAT(F6.2)
      IF(SPANF.LT.0.0) GOTO 6220
      GOTO 6150
6230  WRITE(6,6235)
6235  FORMAT(/7X,'ENTER THE DESIRED LOCATION OF THE CG AS A'/
     &7X,'FRACTION OF THE MEAN AERODYNAMIC CHORD: ',$)
      READ(5,5816,ERR=6230) CGM
      IF((CGM.LT.0.0).OR.(CGM.GT.1.0)) GOTO 6230
      GOTO 6150
6240  WRITE(6,6245)
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 6245 FORMAT(/7X,'ENTER THE CG STATIC MARGIN FACTOR: ',$)
      READ(5,5776,ERR=6240) SM
      IF((SM.LT.0.0).OR.(SM.GT.1.0)) GOTO 6240
      GOTO 6150
 6250 WRITE(6,6255)
 6255 FORMAT(/7X,'ENTER THE HEIGHT OF THE CG ABOVE THE FUSELAGE'/
     &7X,'CENTERLINE (FEET): ',$)
      READ(5,6186,ERR=6250) ZCG
      IF(ZCG.LT.0.0) GOTO 6250
      GOTO 6150
 6260 WRITE(6,6265)
 6265 FORMAT(/7X,'ENTER THE ANGLE OF INCIDENCE OF THE HORIZONTAL'/
     &7X,'TAIL (DEGREES): ',$)
      READ(5,5776,ERR=6260) IT
      IF((IT.LT.0.0).OR.(IT.GT.10.0)) GOTO 6260
      GOTO 6150
C ----------------------------------------------------------------------
C --- AERO PAGE 6
C ----------------------------------------------------------------------
 6280 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6285) (SMN(I),I=1,10), NMDTL, (ALTV(I),I=1,10),
     &(CLINPT(I),I=1,10)
 6285 FORMAT(/
     &7X,'** AERO PAGE 6 **'//
     &7X,'(1) MACH NUMBERS FOR DETAILED AERODYNAMICS OUTPUT: ',F5.3,
     &',',/11X,8(F5.3,','),F5.3//
     &7X,'(2) TOTAL NUMBER OF REQUESTED MACH NUMBERS (ABOVE)..',I2//
     &7X,'(3) ALTITUDES FOR DETAILED AERODYNAMICS OUTPUT: ',F7.1,','
     &,F7.1,','/10X,7(F7.1,','),F7.1//
     &7X,'(4) LIFT COEFFICIENTS FOR DETAILED OUTPUT: ',F6.3,','/
     &11X,8(F6.3,','),F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=6280) NUM
      IF(NUM.EQ.0) GOTO 6360
      GOTO (6300, 6310, 6320, 6330) ,NUM
      GOTO 6280
 6300 WRITE(6,6305)
 6305 FORMAT(/7X,'ENTER THE DESIRED MACH NUMBERS FOR DETAILED'/
     &7X,'AERODYNAMICS OUTPUT. PUT A ",” BETWEEN EACH NUMBER.'/
     &7X,'(A MAXIMUM OF TEN NUMBERS):'//' ENTER: ',$)
      READ(5,6306,ERR=6300) (SMN(I),I=1,10)
 6306 FORMAT(10F6.3)
      DO 6307 I=1,10
        IF((SMN(I).LT.0.0).OR.(SMN(I).GT.3.0)) GOTO 6300
 6307 CONTINUE
      GOTO 6280
 6310 WRITE(6,6315)
 6315 FORMAT(/7X,'ENTER THE TOTAL NUMBER OF MACH NUMBERS THAT ARE'/
     &7X,'ENTERED INTO THE ARRAY (DISREGARD TRAILING ZEROS): ',$)
      READ(5,6160,ERR=6310) NMDTL
      IF((NMDTL.LT.0).OR.(NMDTL.GT.10)) GOTO 6310
      GOTO 6280
 6320 WRITE(6,6325)
 6325 FORMAT(/7X,'ENTER THE ALTITUDES DESIRED FOR THE DETAILED'/
     &7X,'AERODYNAMICS OUTPUT (UP TO 10). PUT A ",” BETWEEN EACH'/
     &7X,'NUMBER.'//' ENTER: ',$)
      READ(5,6326,ERR=6320) (ALTV(I),I=1,10)
 6326 FORMAT(10F8.1)
      DO 6327 I=1,10
        IF((ALTV(I).LT.0.0).OR.(ALTV(I).GT.99999.0)) GOTO 6320
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 6327 CONTINUE
      GOTO 6280
 6330 WRITE(6,6335)
 6335 FORMAT(/7X,'ENTER THE LIFT COEFFICIENTS DESIRED FOR THE'/
     &7X,'DETAILED AERODYNAMICS OUTPUT. PUT A "," BETWEEN EACH'/
     &7X,'NUMBER. (A MAXIMUM OF TEN NUMBERS):'//' ENTER: ',$)
      READ(5,6336,ERR=6330) (CLINPT(I),I=1,10)
 6336 FORMAT(10F7.3)
      DO 6337 I=1,10
        IF((CLINPT(I).LT.0.0).OR.(CLINPT(I).GT.8.0)) GOTO 6330
 6337 CONTINUE
      GOTO 6280
C -----------------------------------------------------------------------
C --- AERO PAGE 7
C -----------------------------------------------------------------------
 6360 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6365) CDBMB(1), CDSTR(1), CDTNK(1), CDEXTR(1)
 6365 FORMAT(/
     &7X,'** AERO PAGE 7 **'//
     &7X,'(1) TOTAL DRAG DUE TO EXTERNAL BOMBS (FT2)......',F6.3/
     &7X,'(2) TOTAL DRAG DUE TO EXTERNAL STORES (FT2)... .',F6.3/
     &7X,'(3) TOTAL DRAG DUE TO DROP TANKS (FT2).......... ,F6.3/
     &7X,'(4) TOTAL DRAG DUE TO ADDITIONAL ITEMS (FT2)....',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=6360) NUM
      IF(NUM.EQ.0) GOTO 6450
      GOTO (6380, 6390, 6400, 6410) ,NUM
      GOTO 6360
 6380 WRITE(6,6385)
 6385 FORMAT(/7X,'ENTER THE DRAG DUE TO EXTERNAL BOMBS (FT2): ',$)
      READ(5,5776,ERR=6380) CDBMB(1)
      IF(CDBMB(1).LT.0.0) GOTO 6380
      GOTO 6360
 6390 WRITE(6,6395)
 6395 FORMAT(/7X,'ENTER THE DRAG DUE TO EXTERNAL STORES (FT2): ',$)
      READ(5,5776,ERR=6390) CDSTR(1)
      IF(CDSTR(1).LT.0.0) GOTO 6390
      GOTO 6360
 6400 WRITE(6,6405)
 6405 FORMAT(/7X,'ENTER THE DRAG DUE TO DROP TANKS (FT2): ',$)
      READ(5,5776,ERR=6400) CDTNK(1)
      IF(CDTNK(1).LT.0.0) GOTO 6400
      GOTO 6360
 6410 WRITE(6,6415)
 6415 FORMAT(/7X,'ENTER THE DRAG DUE TO ADDITIONAL ITEMS (SUCH'/
     &7X,'AS FLIR PODS, PYLONS, ETC...) (FT2). (IF THE NAVY MODULE'/
     &7X,'IS SELECTED, INPUT THE GEAR DOWN DRAG HERE): ',$)
      READ(5,5776,ERR=6410) CDEXTR(1)
C --- IF THE NAVY MODULE WILL BE CALLED, THIS WILL BE USED FOR
C --- THE GEAR DOWN DRAG. THE SECOND VALUE OF CDEXTR AND SMEXTR
C --- ARE USED TO PREVENT THE SCALING FACTOR FROM OCCURING WHEN
C --- USING THE SNODGRASS METHOD. THE GEAR DRAG WILL ONLY BE APPLIED
C --- WHEN THE MACH NUMBER IS BETWEEN 0.0 AND 0.25
      IF(NVFLAG.EQ..TRUE.) THEN
        CDEXTR(2)=CDEXTR(1)
        SMEXTR(1)=0.2
        SMEXTR(2)=0.3
      ENDIF
      IF(CDEXTR(1).LT.0.0) GOTO 6410
      GOTO 6360
```

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C ------------------------------------------------------------------------
C --- AERO PAGE 8
C ------------------------------------------------------------------------
 6450 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6455) CLLAND, CLTO, DELFLD, DELFTO, DELLED, DELLTO,
     &LDLAND, LDTO
 6455 FORMAT(/
     &7X,'** AERO PAGE 8 **'//
     &7X,'(1) CL MAX FOR LANDING...........................',F6.3/
     &7X,'(2) CL MAX FOR TAKE-OFF..........................',F6.3/
     &7X,'(3) TRAILING EDGE FLAP ANGLE FOR LANDING (DEG)....',F6.3/
     &7X,'(4) TRAILING EDGE FLAP ANGLE FOR TAKE-OFF (DEG)...',F6.3/
     &7X,'(5) LEADING EDGE SLAT ANGLE FOR LANDING (DEG).....',F6.3/
     &7X,'(6) LEADING EDGE SLAT ANGLE FOR TAKE-OFF (DEG)....',F6.3/
     &7X,'(7) L/D RATIO FOR LANDING........................',F6.3/
     &7X,'(8) L/D RATIO FOR TAKE-OFF.......................',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,10,ERR=6450) NUM
      IF(NUM.EQ.0) GOTO 6550
      GOTO (6470, 6480, 6490, 6500, 6510, 6520, 6530, 6540) ,NUM
      GOTO 6450
 6470 WRITE(6,6475)
 6475 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR CL MAX'/
     &7X,'DURING LANDING (-1.0 = CALCULATED INTERNALLY): ',$)
      READ(5,5776,ERR=6470) CLLAND
      IF(((CLLAND.LT.0.0).AND.(CLLAND.GT.-1.0)).OR.(CLLAND.LT.-1.0))
     &GOTO 6470
      GOTO 6450
 6480 WRITE(6,6485)
 6485 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR CL MAX'/
     &7X,'DURING TAKE-OFF (-1.0 = CALCULATED INTERNALLY): ',$)
      READ(5,5776,ERR=6480) CLTO
      IF(((CLTO.LT.0.0).AND.(CLTO.GT.-1.0)).OR.(CLTO.LT.-1.0))
     &GOTO 6480
      GOTO 6450
 6490 WRITE(6,6495)
 6495 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR THE TRAILING EDGE'/
     &7X,'FLAP ANGLE ON LANDING (DEGREES): ',$)
      READ(5,5776,ERR=6490) DELFLD
      IF((DELFLD.LT.0.0).OR.(DELFLD.GT.60.0)) GOTO 6490
      GOTO 6450
 6500 WRITE(6,6505)
 6505 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR THE TRAILING EDGE'/
     &7X,'FLAP ANGLE ON TAKE-OFF (DEGREES): ',$)
      READ(5,5776,ERR=6500) DELFTO
      IF((DELFTO.LT.0.0).OR.(DELFTO.GT.60.0)) GOTO 6500
      GOTO 6450
 6510 WRITE(6,6515)
 6515 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR THE LEADING EDGE'/
     &7X,'SLAT ANGLE ON LANDING (DEGREES): ',$)
      READ(5,5776,ERR=6510) DELLED
      IF((DELLED.LT.0.0).OR.(DELLED.GT.60.0)) GOTO 6510
      GOTO 6450
 6520 WRITE(6,6525)
 6525 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR THE LEADING EDGE'/
     &7X,'FLAP ANGLE ON TAKE-OFF (DEGREES): ',$)
      READ(5,5776,ERR=6520) DELLTO
      IF((DELLTO.LT.0.0).OR.(DELLTO.GT.60.0)) GOTO 6520
      GOTO 6450
 6530 WRITE(6,6535)
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6535 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR THE L/D RATIO'/
    &7X,'DURING LANDING (-1.0 = CALCULATED INTERNALLY): ',$)
     READ(5,5776,ERR=6530) LDLAND
     IF(((LDLAND.LT.0.0).AND.(LDLAND.GT.-1.0)).OR.(LDLAND.LT.-1.0))
    &GOTO 6530
     GOTO 6450
6540 WRITE(6,6545)
6545 FORMAT(/7X,'ENTER THE VALUE TO BE USED FOR THE L/D RATIO'/
    &7X,'DURING TAKE-OFF (-1.0 = CALCULATED INTERNALLY): ',$)
     READ(5,5776,ERR=6540) LDTO
     IF(((LDTO.LT.0.0).AND.(LDTO.GT.-1.0)).OR.(LDTO.LT.-1.0))
    &GOTO 6540
     GOTO 6450
6550 WRITE(7,6555) ABOSB, ALMAX, AMC, BDNOSE, BTEF, (CLO(I),I=1,10),
    &(CLOC(I),I=1,10), (CLOW(I),I=1,10), (CMO(I),I=1,10), MACHN,
    &RCLMAX, ROC, ROCAN, SFWF, SMNDR, (SMNSWP(I),I=1,10), SPANAC,
    &SWPMAX, SWPMIN, (YSWP(I),I=1,10), AJCAN, ALELJ, INORM, ISMNDR,
    &ISUPCR, ITRAP, ELLIPC, ELLIPH, ELLIPW, CSF, ESSF, FCDF, CAND,
    &CFLAP, CGM, (FLDM(I),I=1,10), (FVCAM(I),I=1,10), IT, SFLAP,
    &SM, SPANF, ZCG, IVCAM, ITRIM, (ALIN(I),I=1,10),
    &(ALTV(I),I=1,10), (CLINPT(I),I=1,10), (SMN(I),I=1,10),
    &ICOD, IPLOT, NALF, NMDTL, (CDBMB(I),I=1,10), (CDSTR(I),I=1,10),
    &(CDTNK(I),I=1,10), (CDEXTR(I),I=1,10), (SMNBMB(I),I=1,10),
    &(SMSTRS(I),I=1,10), (SMTANK(I),I=1,10), (SMEXTR(I),I=1,10),
    &ICDO, CLLAND, CLTO, DELFLD, DELFTO, DELLED, DELLTO, LDLAND, LDTO
6555 FORMAT(' $ACHAR'/5X,'ABOSB=',F6.3,',',2X,'ALMAX=',F6.3,',',2X,
    &'AMC=',F6.3,','/5X,'BDNOSE=',F6.3,',',1X,'BTEF=',F5.3,','/
    &5X,'CLO=',9(F5.3,','),F5.3/5X,'CLOC=',9(F5.3,','),F5.3/
    &5X,'CLOW=',9(F5.3,','),F5.3/5X,'CMO=',9(F5.3,','),F5.3/
    &5X,'MACHN=',F6.3,',',2X,'RCLMAX=',F6.3,',',1X,'ROC=',F5.3,','/
    &5X,'ROCAN=',F5.3,',',3X,'SFWF=',F5.3,',',4X,'SMNDR=',F5.3,','/
    &5X,'SMNSWP=',9(F5.3,','),F5.3/
    &5X,'SPANAC=',F6.3,',',1X,'SWPMAX=',F6.3,',',1X,'SWPMIN=',F6.3,','/
    &5X,'YSWP=',9(F6.3,','),F6.3/
    &5X,'AJCAN=',I1,',',7X,'ALELJ=',I1,',',7X,'INORM=',I1,','/
    &5X,'ISMNDR=',I1,',',6X,'ISUPCR=',I1,',',6X,'ITRAP=',I1,','/
    &5X,'ELLIPC=',L1,',',6X,'ELLIPH=',L1,',',6X,'ELLIPW=',L1,','/
    &5X,'$END'/' $AMULT'/
    &5X,'CSF=',F5.3,',',5X,'ESSF=',F5.3,',',4X,'FCDF=',F5.2,','/
    &5X,'$END'/' $ATRIM'/
    &5X,'CAND=',F6.3,',',3X,'CFLAP=',F6.3,',',2X,'CGM=',F5.3,','/
    &5X,'FLDM=',9(F6.3,','),F6.3/5X,'FVCAM=',9(F6.3,','),F6.3/
    &5X,'IT=',F6.3,',',5X,'SFLAP=',F7.2,',',1X,'SM=',F6.3,','/
    &5X,'SPANF=',F6.2,',',2X,'ZCG=',F5.2,',',5X,'IVCAM=',I1,','/
    &5X,'ITRIM=',9(I1,','),I1/5X,'$END'/' $ADET'/
    &5X,'ALIN=',9(F4.1,','),F4.1/5X,'ALTV=',9(F6.0,','),F6.0/
    &5X,'CLINPT=',9(F6.3,','),F6.3/5X,'SMN=',9(F5.3,','),F5.3/
    &5X,'ICOD=',I1,',',8X,'IPLOT=',I1,',',7X,'NALF=',I2,','/
    &5X,'NMDTL=',I2,','/5X,'$END'/' $ADRAG'/
    &5X,'CDBMB=',9(F6.3,','),F6.3/5X,'CDSTR=',9(F6.3,','),F6.3/
    &5X,'CDTNK=',9(F6.3,','),F6.3/5X,'CDEXTR=',9(F6.3,','),F6.3/
    &5X,'SMNBMB=',9(F5.3,','),F5.3/5X,'SMSTRS=',9(F5.3,','),F5.3/
    &5X,'SMTANK=',9(F5.3,','),F5.3/5X,'SMEXTR=',9(F5.3,','),F5.3/
    &5X,'ICDO=',I1,','/5X,'$END'/' $ATAKE'/
    &5X,'CLLAND=',F6.3,',',1X,'CLTO=',F6.3,',',3X,'DELFLD=',F6.3,','/
    &5X,'DELFTO=',F6.3,',',1X,'DELLED=',F6.3,',',1X,'DELLTO=',F6.3,','/
    &5X,'LDLAND=',F6.3,',',1X,'LDTO=',F6.3,','/5X,'$END'/
    &' $APRINT  ECHOIN=0,  IPFLAP=1,  IPCAN=1,'/5X,'$END')
     RETURN
     END
```

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C =====================================================================
      SUBROUTINE PROP(DVFLAG)
C ---------------------------------------------------------------------
C --- PROPULSION MODULE
C ---------------------------------------------------------------------
      LOGICAL DVFLAG
      CHARACTER ANS*6, TITLE*80, PHASE*8
      INTEGER EN
      REAL MACH1, MACH2
      DIMENSION ALTD(6), XMACH(6)
 6590 IF(DVFLAG.EQ..FALSE.) THEN       !GIVE OPTION TO BYPASS
 6600   STATUS = LIB$SPAWN('CLS')
        WRITE(6,6605)
 6605   FORMAT(//
     &  7X,'DO YOU WANT TO MAKE ANY CHANGES TO THE ENGINE CYCLE'/
     &  7X,'ANALYSIS?'//7X,'(1) YES'/7X,'(2) NO'//
     &  7X,'SELECT 1 OR 2: ',$)
        READ(5,6606,ERR=6600) NUM
 6606   FORMAT(I1)
        IF(NUM.EQ.1) GOTO 6650
        IF(NUM.NE.2) GOTO 6600
C ---   TRANSFER THE $LEWIS NAMELIST FROM (10) TO (7)
        REWIND(10)
 6610   READ(10,6611) ANS
 6611   FORMAT(A6)
        IF(ANS.NE.'*** PR') GOTO 6610
        WRITE(7,6615)
 6615   FORMAT('*** PROPULSION DATA ***')
        DO 6630 I=1,30
          READ(10,6616) TITLE
 6616     FORMAT(A80)
          WRITE(7,6616) TITLE
 6630   CONTINUE
        RETURN
      ENDIF
C --- NAMELIST LEWIS
 6650 IF(DVFLAG.EQ..FALSE.) THEN
        REWIND(10)
 6660   READ(10,6611,END=6690) ANS
        IF(ANS.NE.'*** PR') GOTO 6660
        READ(10,6670) ITYPE, AENDIA, AENLE, AENWT, ATURB,
     &  BA, DIA1, FRBT, FRPN, HTR, HVF, PCDFAC, PWCC, RDIAM, RLENG,
     &  SM1, SODG, VC1, WCWA1, YREN, ESF, TWAB, TWOAB, TWTO, EAB1,
     &  EB1, ED1, ETAC1, ETAF1, ETAT1, PRFD, P11P1, P2P1, R32, R54,
     &  R54N, R711, R711N, SCPR, DELT57, T3, T51, T71, DELPR, R10A,
     &  MACH1, MACH2, SFBTP, SFINSP, SFIP, SFSFC1, SFSFC2, SFSFC3,
     &  (ALTD(I),I=1,6), (XMACH(I),I=1,6), DEPWCC, EN, IPR, KODE,
     &  KT5, KT7, NOZZ, NPUSE, IPLOT, IPRINT, KERROR, MINPR, MODPRT,
     &  NAB, NDTAIL, NSUMM, ALTI, AM, POSA, TOSA
 6670   FORMAT(I1//12X,F7.3,7X,F7.3,8X,F8.2/26X,F6.3,6X,F6.3/  !ARERTO
     &  10X,F6.3,9X,F6.3,9X,F6.3/9X,F6.3,9X,F10.2,8X,F6.3/
     &  10X,F7.3,9X,F6.3,9X,F6.3/9X,F6.3,10X,F6.3,8X,F6.3/
     &  11X,F6.3,8X,F5.2,9X,F5.2/10X,F8.1,8X,F8.1,6X,F5.2/
     &  10X,F5.3,9X,F5.3,10X,F5.3/11X,F5.3,10X,F5.3,10X,F5.3/
     &  10X,F6.3,10X,F6.3,8X,F6.3/9X,F6.3,9X,F6.3,10X,F6.3/
     &  10X,F6.3,10X,F6.3,8X,F6.3/12X,F7.2,4X,F8.2,8X,F8.2/
     &  9X,F8.2,9X,F7.2,7X,F4.1/11X,F6.3,9X,F6.3,9X,F6.3/
     &  12X,F6.3,7X,F6.3,11X,F6.3/12X,F6.3,9X,F6.3/10X,6F8.1/
     &  11X,6F7.3/12X,F6.3,5X,I2,14X,I2/10X,I1,13X,I2,13X,I2/
     &  10X,I1,15X,I1,14X,I1/12X,I1,14X,I1,13X,I1/
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     &  12X,I1,11X,I1,17X,I2/11X,I2,12X,F3.1,10X,F3.1/
     &  10X,F5.2,10X,F5.1)
      ENDIF
      IF(DVFLAG.EQ..TRUE.) ITYPE=6
 6690 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6695) ITYPE
 6695 FORMAT(/
     &7X,'SELECT THE ENGINE TYPE THAT IS CLOSEST TO YOUR DESIGN.'/
     &7X,'YOU CAN THEN ALTER THE VARIABLES TO SUIT YOUR NEEDS.'//
     &7X,'** CAUTION **  MAKING A CHANGE OF ENGINE TYPE WILL'/
     &7X,'DESTROY ANY ENGINE VARIABLES THAT YOU PREVIOUSLY SET'/
     &7X,'AND RESET THEM FOR THE NEW ENGINE TYPE. (YOU WILL NEED'/
     &7X,'TO GO THROUGH EACH ENGINE PAGE AND REENTER THE VALUES)'//
     &7X,'ENGINE TYPE: ',I1/
     &7X,'1 = J85  (TURBOJET, 2700 LBS THRUST)'/
     &7X,'2 = TF30 (TURBOFAN, 0.7 BYPASS, 14500 LBS THRUST)'/
     &7X,'3 = JT8D (TURBOFAN, 1.0 BYPASS, 14500 LBS THRUST)'/
     &7X,'4 = JT9D (TURBOFAN, 8.2 BYPASS, 50000 LBS THRUST)'/
     &7X,'5 = CF6  (TURBOFAN, 4.4 BYPASS, 50000 LBS THRUST)'/
     &7X,'6 = GENERIC (TURBOFAN, 6.2 BYPASS, 9300 LBS THRUST)'//
     &7X,'(1) CHANGE ENGINE TYPE'/7X,'(2) NO CHANGE'//
     &7X,'SELECT 1 OR 2: ',$)
      READ(5,6606,ERR=6690) NUM
      IF((NUM.NE.1).AND.(NUM.NE.2)) GOTO 6690
      IF((NUM.EQ.2).AND.(DVFLAG.EQ..TRUE.)) THEN
        CALL LEWIS(ITYPE, AENDIA, AENLE, AENWT, ARERTO, ATURB,
     &  BA, DIA1, FRBT, FRPN, HTR, HVF, PCDFAC, PWCC, RDIAM, RLENG,
     &  SM1, SODG, VC1, WCWA1, YREN, ESF, TWAB, TWOAB, TWTO, EAB1,
     &  EB1, ED1, ETAC1, ETAF1, ETAT1, PRFD, P11P1, P2P1, R32, R54,
     &  R54N, R711, R711N, SCPR, DELT57, T3, T51, T71, DELPR, R10A,
     &  MACH1, MACH2, SFBTP, SFINSP, SFIP, SFSFC1, SFSFC2, SFSFC3,
     &  ALTD, XMACH, DEPWCC, EN, IPR, KODE, KT5, KT7, NOZZ, NPUSE,
     &  IPLOT, IPRINT, KERROR, MINPR, MODPRT, NAB, NDTAIL, NSUMM, ALTI,
     &  AM, POSA, TOSA)
        GOTO 6720
      ENDIF
      IF(NUM.EQ.2) GOTO 6720
      IF(NUM.EQ.1) THEN
 6700  WRITE(6,6705)
 6705  FORMAT(/7X,'ENTER THE NEW ENGINE TYPE (1,2,3,4,5, OR 6): ',$)
       READ(5,6606,ERR=6700) ITYPE
       IF((ITYPE.LT.1).OR.(ITYPE.GT.6)) GOTO 6700
        CALL LEWIS(ITYPE, AENDIA, AENLE, AENWT, ARERTO, ATURB,
     &  BA, DIA1, FRBT, FRPN, HTR, HVF, PCDFAC, PWCC, RDIAM, RLENG,
     &  SM1, SODG, VC1, WCWA1, YREN, ESF, TWAB, TWOAB, TWTO, EAB1,
     &  EB1, ED1, ETAC1, ETAF1, ETAT1, PRFD, P11P1, P2P1, R32, R54,
     &  R54N, R711, R711N, SCPR, DELT57, T3, T51, T71, DELPR, R10A,
     &  MACH1, MACH2, SFBTP, SFINSP, SFIP, SFSFC1, SFSFC2, SFSFC3,
     &  ALTD, XMACH, DEPWCC, EN, IPR, KODE, KT5, KT7, NOZZ, NPUSE,
     &  IPLOT, IPRINT, KERROR, MINPR, MODPRT, NAB, NDTAIL, NSUMM, ALTI,
     &  AM, POSA, TOSA)
       GOTO 6690
      ENDIF
C -----------------------------------------------------------------
C --- ENGINE PAGE 1
C -----------------------------------------------------------------
 6720 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6725) AENDIA, AENLE, AENWT, ATURB, BA, DIA1,
     &FRBT, FRPN
 6725 FORMAT(/
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     &7X,'** PROPULSION PAGE 1 **'//
     &7X,'(1) ACTUAL ENGINE DIAMETER (FT)...............',F7.3/
     &7X,'(2) ACTUAL ENGINE LENGTH (FT).................',F7.3/
     &7X,'(3) ACTUAL ENGINE WEIGHT (LBS)..............',F8.2/
     &7X,'(4) INNER TURBINE FLOW AREA (FT2)..............',F6.3/
     &7X,'(5) BYPASS RATIO..............................',F6.3/
     &7X,'(6) ENGINE FACE DIAMETER (FT).................',F6.3/
     &7X,'(7) NOZZLE FINENESS RATIO......................',F6.3/
     &7X,'(8) COWL FINENESS RATIO.......................',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6606,ERR=6720) NUM
      IF(NUM.EQ.0) GOTO 6840
      GOTO (6740, 6750, 6760, 6780, 6790, 6800, 6810, 6820) ,NUM
      GOTO 6720
6740  WRITE(6,6745)
6745  FORMAT(/7X,'ENTER THE ENGINE DIAMETER. IF 0.0 IS USED, THE'/
     &7X,'ENGINE WILL BE SIZED AUTOMATICALLY (FEET): ',$)
      READ(5,6746,ERR=6740) AENDIA
6746  FORMAT(F7.3)
      IF((AENDIA.LT.0.0).OR.(AENDIA.GT.30.0)) GOTO 6740
      GOTO 6720
6750  WRITE(6,6755)
6755  FORMAT(/7X,'ENTER THE ENGINE LENGTH. IF 0.0 IS USED, THE'/
     &7X,'ENGINE WILL BE SIZED AUTOMATICALLY (FEET): ',$)
      READ(5,6746,ERR=6750) AENLE
      IF((AENLE.LT.0.0).OR.(AENLE.GT.60.0)) GOTO 6750
      GOTO 6720
6760  WRITE(6,6765)
6765  FORMAT(/7X,'ENTER THE ENGINE WEIGHT. IF 0.0 IS USED, THE'/
     &7X,'ENGINE WILL BE SIZED AUTOMATICALLY (LBS): ',$)
      READ(5,6766,ERR=6760) AENWT
6766  FORMAT(F8.2)
      IF((AENWT.LT.0.0).OR.(AENWT.GT.100000)) GOTO 6760
      GOTO 6720
6780  WRITE(6,6785)
6785  FORMAT(/7X,'ENTER THE INNER TURBINE FLOW AREA (FT2): ',$)
      READ(5,6786,ERR=6780) ATURB
6786  FORMAT(F6.3)
      IF((ATURB.LE.0.0).OR.(ATURB.GT.10.0)) GOTO 6780
      GOTO 6720
6790  WRITE(6,6795)
6795  FORMAT(/7X,'ENTER THE BYPASS RATIO: ',$)
      READ(5,6786,ERR=6790) BA
      IF((BA.LT.0.0).OR.(BA.GT.30.0)) GOTO 6790
      GOTO 6720
6800  WRITE(6,6805)
6805  FORMAT(/7X,'ENTER THE ENGINE FACE DIAMETER (FT): ',$)
      READ(5,6786,ERR=6800) DIA1
      IF((DIA1.LT.0.0).OR.(DIA1.GT.30.0)) GOTO 6800
      GOTO 6720
6810  WRITE(6,6815)
6815  FORMAT(/7X,'ENTER THE NOZZLE FINENESS RATIO '/
     &7X,'(NOZZLE LENGTH/NOZZLE MAX DIAMTER): ',$)
      READ(5,6786,ERR=6810) FRBT
      IF(FRBT.LT.0.0) GOTO 6810
      GOTO 6720
6820  WRITE(6,6825)
6825  FORMAT(/7X,'ENTER THE COWL FINENESS RATIO'/
     &7X,'(COWL LENGTH/COWL MAX DIAMETER): ',$)
      READ(5,6786,ERR=6820) FRPN
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      IF(FRPN.LT.0.0) GOTO 6820
      GOTO 6720
C ------------------------------------------------------------------
C --- PROPULSION PAGE 2
C ------------------------------------------------------------------
 6840 STATUS = LIB$SPAWN('CLS')
      WRITE(6,6845) HTR, HVF, PCDFAC, PWCC, RDIAM, RLENG,
     &SM1, SODG, VC1
 6845 FORMAT(/
     &7X,'** PROPULSION PAGE 2 **'//
     &7X,'(1) ENGINE HUB/TIP RATIO.......................',F6.3/
     &7X,'(2) FUEL HEAT VALUE (BTU/LBM)..............',F10.2/
     &7X,'(3) SCALING FACTOR FOR INLET CAPTURE AREA.......',F6.3/
     &7X,'(4) ENGINE PERCENT CORRECTED AIRFLOW...........',F7.3/
     &7X,'(5) MAXIMUM NACELLE DIAMETER FACTOR.............',F6.3/
     &7X,'(6) TOTAL NACELLE LENGTH FACTOR.................',F6.3/
     &7X,'(7) ENGINE FACE MACH NUMBER.....................',F6.3/
     &7X,'(8) DISTANCE BETWEEN NOZZLES/NOZZLE DIAMETER....',F6.3/
     &7X,'(9) NOZZLE VELOCITY COEFFICIENT.................',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6606,ERR=6840) NUM
      IF(NUM.EQ.0) GOTO 7000
      GOTO (6860, 6870, 6880, 6890, 6900, 6910, 6920, 6930, 6940) ,NUM
      GOTO 6840
 6860 WRITE(6,6865)
 6865 FORMAT(/7X,'ENTER THE ENGINE HUB/TIP RATIO: ',$)
      READ(5,6786,ERR=6860) HTR
      IF((HTR.LE.0.0).OR.(HTR.GE.1.0)) GOTO 6860
      GOTO 6840
 6870 WRITE(6,6875)
 6875 FORMAT(/7X,'ENTER THE FUEL HEAT VALUE (BTU/LBM): ',$)
      READ(5,6876,ERR=6870) HVF
 6876 FORMAT(F10.2)
      IF((HVF.LT.14000.0).OR.(HVF.GT.22000.0)) GOTO 6870
      GOTO 6840
 6880 WRITE(6,6885)
 6885 FORMAT(/7X,'ENTER THE SCALING FACTOR FOR THE INLET'/
     &7X,'CAPTURE AREA: ',$)
      READ(5,6786,ERR=6880) PCDFAC
      IF((PCDFAC.LT.0.5).OR.(PCDFAC.GT.1.5)) GOTO 6880
      GOTO 6840
 6890 WRITE(6,6895)
 6895 FORMAT(/7X,'ENTER THE ENGINE PERCENT CORRECTED AIRFLOW: ',$)
      READ(5,6896,ERR=6890) PWCC
 6896 FORMAT(F5.3)
      IF((PWCC.LT.50.0).OR.(PWCC.GT.150.0)) GOTO 6890
      GOTO 6840
 6900 WRITE(6,6905)
 6905 FORMAT(/7X,'ENTER THE MAXIMUM NACELLE DIAMETER FACTOR. '/
     &7X,'(ENGINE DIAMETER * DIAMETER FACTOR = NACELLE DIAMETER): '
     &,$)
      READ(5,6786,ERR=6900) RDIAM
      IF((RDIAM.LT.1.0).OR.(RDIAM.GT.2.0)) GOTO 6900
      GOTO 6840
 6910 WRITE(6,6915)
 6915 FORMAT(/7X,'ENTER THE NACELLE LENGTH FACTOR. (ENGINE'/
     &7X,' LENGTH * LENGTH FACTOR = NACELLE LENGTH): ',$)
      READ(5,6786,ERR=6910) RLENG
      IF((RLENG.LT.1.0).OR.(RLENG.GT.3.0)) GOTO 6910
      GOTO 6840
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 6920 WRITE(6,6925)
 6925 FORMAT(/7X,'ENTER THE ENGINE FACE MACH NUMBER: ',$)
      READ(5,6786,ERR=6920) SM1
      IF((SM1.LE.0.0).OR.(SM1.GT.2.0)) GOTO 6920
      GOTO 6840
 6930 WRITE(6,6935)
 6935 FORMAT(/7X,'ENTER THE DISTANCE BETWEEN THE EXHAUST NOZZLES'/
     &7X,'DIVIDED BY THE NOZZLE EXIT DIAMETER: ',$)
      READ(5,6786,ERR=6930) SODG
      IF(SODG.LT.1.0)  GOTO 6930
      GOTO 6840
 6940 WRITE(6,6945)
 6945 FORMAT(/7X,'ENTER THE NOZZLE VELOCITY COEFFICIENT: ',$)
      READ(5,6786,ERR=6940) VC1
      IF((VC1.LT.0.6).OR.(VC1.GT.1.0))  GOTO 6940
      GOTO 6840
C ------------------------------------------------------------------
C --- PROPULSION PAGE 3
C ------------------------------------------------------------------
 7000 STATUS = LIB$SPAWN('CLS')
      WRITE(6,7005) WCWA1, YREN, TWAB, TWOAB, TWTO, EAB1, EB1, ED1,
     &ETAC1
 7005 FORMAT(/
     &7X,'** PROPULSION PAGE 3 **'//
     &7X,'(1) COOLING/PRIMARY AIRFLOW RATIO...........',F6.3/
     &7X,'(2) YEAR OF ENGINE INSTALLATION.............',F5.2/
     &7X,'(3) THRUST W/AFTERBURNER AT SEA-LEVEL...',F8.1/
     &7X,'(4) THRUST W/O AFTERBURNER AT SEA-LEVEL.',F8.1/
     &7X,'(5) THRUST/WEIGHT RATIO AT TAKE-OFF.........',F5.2/
     &7X,'(6) AFTERBURNER ADIABATIC EFFICIENCY.........',F5.3/
     &7X,'(7) COMBUSTER ADIABATIC EFFICIENCY...........',F5.3/
     &7X,'(8) DUCT BURNER ADIABATIC EFFICIENCY.........',F5.3/
     &7X,'(9) COMPRESSOR ADIABATIC EFFICIENCY..........',F5.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6606,ERR=7000) NUM
      IF(NUM.EQ.0) GOTO 7130
      GOTO (7020, 7030, 7040, 7050, 7060, 7070, 7080, 7090, 7100) ,NUM
      GOTO 7000
 7020 WRITE(6,7025)
 7025 FORMAT(/7X,'ENTER THE COOLING/PRIMARY AIRFLOW RATIO: ',$)
      READ(5,6786,ERR=7020) WCWA1
      IF((WCWA1.LT.0.0).OR.(WCWA1.GT.0.2)) GOTO 7020
      GOTO 7000
 7030 WRITE(6,7035)
 7035 FORMAT(/7X,'ENTER THE YEAR OF ENGINE INSTALLATION'/
     &7X,'(IF THE YEAR IS 1991, ENTER "91"): ',$)
      READ(5,7036,ERR=7030) YREN
 7036 FORMAT(F5.2)
      GOTO 7000
 7040 WRITE(6,7045)
 7045 FORMAT(/7X,'ENTER THE ENGINE THRUST WITH AFTERBURNER ON AT'/
     &7X,'SEA-LEVEL, STATIC. (THE ENGINE SIZING FLAG SHOULD BE SET'/
     &7X,'TO -2 IN THE TRAJECTORY MODULE): ',$)
      READ(5,7046,ERR=7040) TWAB
 7046 FORMAT(F8.1)
      IF((TWAB.LT.0.0).OR.(TWAB.GT.999999.0)) GOTO 7040
      GOTO 7000
 7050 WRITE(6,7055)
 7055 FORMAT(/7X,'ENTER THE ENGINE THRUST WITHOUT AFTERBURNER AT'/
     &7X,'SEA-LEVEL, STATIC. (THE ENGINE SIZING FLAG SHOULD BE SET'/
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     &7X,'TO -3 IN THE TRAJECTORY MODULE): ',$)
      READ(5,7046,ERR=7050) TWOAB
      IF((TWOAB.LT.0.0).OR.(TWOAB.GT.999999.0)) GOTO 7050
      GOTO 7000
 7060 WRITE(6,7065)
 7065 FORMAT(/7X,'ENTER THE THRUST/WEIGHT RATIO AT TAKE-OFF. (THE'/
     &7X,'ENGINE SIZING FLAG SHOULD BE SET TO 0 OR -1 IN THE'/
     &7X,'TRAJECTORY MODULE): ',$)
      READ(5,7036,ERR=7060) TWTO
      IF((TWTO.LE.0.0).OR.(TETO.GT.10.0)) GOTO 7060
      GOTO 7000
 7070 WRITE(6,7075)
 7075 FORMAT(/7X,'ENTER THE AFTERBURNER ADIABATIC EFFICIENCY: ',$)
      READ(5,6896,ERR=7070) EAB1
      IF((EAB1.LT.0.6).OR.(EAB1.GT.1.0)) GOTO 7070
      GOTO 7000
 7080 WRITE(6,7085)
 7085 FORMAT(/7X,'ENTER THE COMBUSTER ADIABATIC EFFICIENCY: ',$)
      READ(5,6896,ERR=7080) EB1
      IF((EB1.LT.0.6).OR.(EB1.GT.1.0)) GOTO 7080
      GOTO 7000
 7090 WRITE(6,7095)
 7095 FORMAT(/7X,'ENTER THE DUCT BURNER ADIABATIC EFFICIENCY: ',$)
      READ(5,6896,ERR=7090) ED1
      IF((ED1.LT.0.6).OR.(ED1.GT.1.0)) GOTO 7090
      GOTO 7000
 7100 WRITE(6,7105)
 7105 FORMAT(/7X,'ENTER THE COMPRESSOR ADIABATIC EFFICIENCY: ',$)
      READ(5,6896,ERR=7100) ETAC1
      IF((ETAC1.LT.0.6).OR.(ETAC1.GT.1.0)) GOTO 7100
      GOTO 7000
C -------------------------------------------------------------------
C --- PROPULSION PAGE 4
C ----------------------------------------- -------------------------
 7130 STATUS = LIB$SPAWN('CLS')
      WRITE(6,7135) ETAF1, ETAT1, PRFD, P11P1, P2P1, R32, R54,
     &R54N, R711, R711N
 7135 FORMAT(/
     &7X,'** PROPULSION PAGE 4 **'//
     &7X,'(1)  FAN ADIABATIC EFFICIENCY.................',F5.3/
     &7X,'(2)  TURBINE ADIABATIC EFFICIENCY.............',F5.3/
     &7X,'(3)  DESIGN FAN PRESSURE RATIO...............',F6.3/
     &7X,'(4)  OUTER COMPRESSOR PRESSURE RATIO.........',F6.3/
     &7X,'(5)  OVERALL COMPRESSOR PRESSURE RATIO.......',F6.3/
     &7X,'(6)  COMBUSTER PRESSURE RATIO................',F6.3/
     &7X,'(7)  AFTERBURNER PRESSURE RATIO..............',F6.3/
     &7X,'(8)  AFTERBURNER PRESSURE RATIO W/O AB LIT...',F6.3/
     &7X,'(9)  DUCTBURNER PRESSURE RATIO...............',F6.3/
     &7X,'(10) DUCTBURNER PRESSURE RATIO W/O DB LIT....',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,7136,ERR=7130) NUM
 7136 FORMAT(I2)
      IF(NUM.EQ.0) GOTO 7270
      GOTO (7150, 7160, 7170, 7180, 7190, 7200, 7210, 7220, 7230, 7240)
     &,NUM
      GOTO 7130
 7150 WRITE(6,7155)
 7155 FORMAT(/7X,'ENTER THE FAN ADIABATIC EFFICIENCY: ',$)
      READ(5,6896,ERR=7150) ETAF1
      IF((ETAF1.LT.0.6).OR.(ETAF1.GT.1.0)) GOTO 7150
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      GOTO 7130
 7160 WRITE(6,7165)
 7165 FORMAT(/7X,'ENTER THE TURBINE ADIABATIC EFFICIENCY: ',$)
      READ(5,6896,ERR=7160) ETAT1
      IF((ETAT1.LT.0.6).OR.(ETAT1.GT.1.0)) GOTO 7160
      GOTO 7130
 7170 WRITE(6,7175)
 7175 FORMAT(/7X,'ENTER THE DESIGN FAN PRESURE RATIO: ',$)
      READ(5,6786,ERR=7170) PRFD
      IF((PRFD.LT.1.0).OR.(PRFD.GT.10.0)) GOTO 7170
      GOTO 7130
 7180 WRITE(6,7185)
 7185 FORMAT(/7X,'ENTER THE OUTER COMPRESSOR PRESSURE RATIO: ',$)
      READ(5,6786,ERR=7180) P11P1
      IF((P11P1.LT.1.0).OR.(P11P1.GT.15.0)) GOTO 7180
      GOTO 7130
 7190 WRITE(6,7195)
 7195 FORMAT(/7X,'ENTER THE OVERALL COMPRESSOR PRESSURE RATIO: ',$)
      READ(5,6786,ERR=7190) P2P1
      IF((P2P1.LT.3.0).OR.(P2P1.GT.50.0)) GOTO 7190
      GOTO 7130
 7200 WRITE(6,7205)
 7205 FORMAT(/7X,'ENTER THE COMBUSTER PRESSURE RATIO: ',$)
      READ(5,6786,ERR=7200) R32
      IF((R32.LT.0.6).OR.(R32.GT.1.0)) GOTO 7200
      GOTO 7130
 7210 WRITE(6,7215)
 7215 FORMAT(/7X,'ENTER THE AFTERBURNER PRESSURE RATIO: ',$)
      READ(5,6786,ERR=7210) R54
      IF((R54.LT.0.6).OR.(R54.GT.1.0)) GOTO 7210
      GOTO 7130
 7220 WRITE(6,7225)
 7225 FORMAT(/7X,'ENTER THE AFTERBURNER PRESSURE RATIO WITHOUT'/
     &7X,'THE AFTERBURNER LIT: ',$)
      READ(5,6786,ERR=7220) R54N
      IF((R54N.LT.0.6).OR.(R54N.GT.1.0)) GOTO 7220
      GOTO 7130
 7230 WRITE(6,7235)
 7235 FORMAT(/7X,'ENTER THE DUCTBURNER PRESSURE RATIO: ',$)
      READ(5,6786,ERR=7230) R711
      IF((R711.LT.0.6).OR.(R711.GT.1.0)) GOTO 7230
      GOTO 7130
 7240 WRITE(6,7245)
 7245 FORMAT(/7X,'ENTER THE DUCTBURNER PRESSURE RATIO WITHOUT THE'/
     &7X,'DUCTBURNER LIT: ',$)
      READ(5,6786,ERR=7240) R711N
      IF((R711N.LT.0.6).OR.(R711N.GT.1.0)) GOTO 7240
      GOTO 7130
C -----------------------------------------------------------------
C --- PROPULSION PAGE 5
C -----------------------------------------------------------------
 7270 STATUS = LIB$SPAWN('CLS')
      WRITE(6,7275) SCPR, T3, T51, T71, DELPR, EN, IPR
 7275 FORMAT(/
     &7X,'** PROPULSION PAGE 5 **'//
     &7X,'(1) AVERAGE COMPRESSOR STAGE RISE (PSI)..........',F6.3/
     &7X,'(2) TURBINE INLET TEMPERATURE (DEGREES R).....',F8.2/
     &7X,'(3) AFTERBURNER MAX TEMPERATURE (DEGREES R)...',F8.2/
     &7X,'(4) DUCTBURNER MAX TEMPERATURE (DEGREES R)....',F8.2/
     &7X,'(5) INCREMENTAL INLET TOTAL PRESSURE'/
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     &7X,'     RECOVERY REDUCTION........................',F7.2/
     &7X,'(6) NUMBER OF ENGINES...........................',I2/
     &7X,'(7) INLET PRESSURE RECOVERY CODE.................',I2//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6606,ERR=7270) NUM
      IF(NUM.EQ.0) GOTO 7400
      GOTO (7290, 7300, 7310, 7320, 7330, 7340, 7350) ,NUM
      GOTO 7270
 7290 WRITE(6,7295)
 7295 FORMAT(/7X,'ENTER THE AVERAGE COMPRESSOR STAGE RISE: ',$)
      READ(5,6786,ERR=7290) SCPR
      IF((SCPR.LT.1.0).OR.(SCPR.GT.3.0)) GOTO 7290
      GOTO 7270
 7300 WRITE(6,7305)
 7305 FORMAT(/7X,'ENTER THE TURBINE INLET TEMPERATURE (DEGREES R): '
     &,$)
      READ(5,6766,ERR=7300) T3
      IF((T3.LT.1500.0).OR.(T3.GT.4000.0)) GOTO 7300
      GOTO 7270
 7310 WRITE(6,7315)
 7315 FORMAT(/7X,'ENTER THE AFTERBURNER MAX TEMPERATURE'/
     &7X,'(ENTER 0.0 IF NO AB) (DEGREES R): ',$)
      READ(5,6766,ERR=7310) T51
      IF(T51.LT.0.0) GOTO 7310
      GOTO 7270
 7320 WRITE(6,7325)
 7325 FORMAT(/7X,'ENTER THE DUCTBURNER MAX TEMPERATURE'/
     &7X,'(ENTER 0.0 IF NO DB) (DEGREES R): ',$)
      READ(5,6766,ERR=7320) T71
      IF(T71.LT.0.0) GOTO 7320
      GOTO 7270
 7330 WRITE(6,7335)
 7335 FORMAT(/7X,'ENTER THE INCREMENTAL INLET TOTAL PRESSURE'/
     &7X,'RECOVERY REDUCTION. INPUT AS A POSITIVE NUMBER (PSI): ',$)
      READ(5,7336,ERR=7330) DELPR
 7336 FORMAT(F7.2)
      IF((DELPR.LT.0.0).OR.(DELPR.GT.1.0)) GOTO 7330
      GOTO 7270
 7340 WRITE(6,7345)
 7345 FORMAT(/7X,'ENTER THE NUMBER OF ENGINES: ',$)
      READ(5,7136,ERR=7340) EN
      IF((EN.LT.1).OR.(EN.GT.10)) GOTO 7340
      GOTO 7270
 7350 WRITE(6,7355)
 7355 FORMAT(/7X,'ENTER THE INLET PRESSURE RECOVERY CODE'/
     &7X,'(1 = AIA RAM RECOVERY)'/
     &7X,'(2 = MILSPEC-5008B)'/
     &7X,'(3 = NORMAL SHOCK)'/
     &7X,'(4 = TABLE LOOK-UP): ',$)
      READ(5,7136,ERR=7350) IPR
      IF((IPR.LT.1).OR.(IPR.GT.4)) GOTO 7350
      GOTO 7270
C ---------------------------------------------------------------------
C --- PROPULSION PAGE 6
C ---------------------------------------------------------------------
 7400 STATUS = LIB$SPAWN('CLS')
      WRITE(6,7405) SFSFC1, MACH1, SFSFC2, MACH2, SFSFC3, SFBTP,
     &SFINSP, SFIP
 7405 FORMAT(/
     &7X,'** PROPULSION PAGE 6 **'//
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     &7X,'(1) SFC MULTIPLYING FACTOR FOR CONDITION ONE......',F6.3/
     &7X,'(2) UPPER LIMIT ON MACH NUMBER FOR CONDITION ONE..',F6.3/
     &7X,'(3) SFC MULTIPLYING FACTOR FOR CONDITION TWO......',F6.3/
     &7X,'(4) LOWER LIMIT ON MACH NUMBER FOR CONDITION TWO..',F6.3/
     &7X,'(5) SFC MULTIPLYING FACTOR FOR BURNER LIT.........',F6.3/
     &7X,'(6) SCALE FACTOR FOR NOZZLE BOAT-TAIL DRAG........',F6.3/
     &7X,'(7) SCALE FACTOR FOR TOTAL INSTALLATION DRAG......',F6.3/
     &7X,'(8) SCALE FACTOR FOR NOZZLE INTERFERENCE DRA..... ',F6.3//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6606,ERR=7400) NUM
      IF(NUM.EQ.0) GOTO 7510
      GOTO (7420, 7430, 7440, 7450, 7460, 7470, 7480, 7490) ,NUM
      GOTO 7400
 7420 WRITE(6,7425)
 7425 FORMAT(/7X,'ENTER THE SPECIFIC FUEL CONSUMPTION MULTIPLYING'/
     &7X,'FACTOR FOR THE FIRST CONDITION: ',$)
      READ(5,6786,ERR=7420) SFSFC1
      IF((SFSFC1.LT.0.3).OR.(SFSFC1.GT.3.0)) GOTO 7420
      GOTO 7400
 7430 WRITE(6,7435)
 7435 FORMAT(/7X,'ENTER THE UPPER LIMIT ON MACH NUMBER FOR THE'/
     &7X,'FIRST CONDITION: ',$)
      READ(5,6786,ERR=7430) MACH1
      IF((MACH1.LT.0.0).OR.(MACH1.GT.3.0)) GOTO 7430
      GOTO 7400
 7440 WRITE(6,7445)
 7445 FORMAT(/7X,'ENTER THE SPECIFIC FUEL CONSUMPTION MULTIPLYING'/
     &7X,'FACTOR FOR THE SECOND CONDITION: ',$)
      READ(5,6786,ERR=7440) SFSFC2
      IF((SFSFC2.LT.0.3).OR.(SFSFC2.GT.3.0)) GOTO 7440
      GOTO 7400
 7450 WRITE(6,7455)
 7455 FORMAT(/7X,'ENTER THE LOWER LIMIT ON MACH NUMBER FOR THE'/
     &7X,'SECOND CONDITION (MUST BE GREATER THAN THE MACH NUMBER'/
     &7X,'LIMIT ON CONDITION ONE): ',$)
      READ(5,6786,ERR=7450) MACH2
      IF(((MACH2.LT.0.0).OR.(MACH2.GT.3.0)).OR.(MACH2.LT.MACH1))
     &GOTO 7450
      GOTO 7400
 7460 WRITE(6,7465)
 7465 FORMAT(/7X,'ENTER THE SPECIFIC FUEL CONSUMPTION MULTIPLYING'/
     &7X,'FACTOR FOR AFTERBURNER LIT: ',$)
      READ(5,6786,ERR=7460) SFSFC3
      IF((SFSFC3.LT.0.3).OR.(SFSFC3.GT.10.0)) GOTO 7460
      GOTO 7400
 7470 WRITE(6,7475)
 7475 FORMAT(/7X,'ENTER THE SCALE FACTOR FOR THE NOZZLE'/
     &7X,'BOAT-TAIL DRAG: ',$)
      READ(5,6786,ERR=7470) SFBTP
      IF((SFBTP.LT.0.0).OR.(SFBTP.GT.2.0)) GOTO 7470
      GOTO 7400
 7480 WRITE(6,7485)
 7485 FORMAT(/7X,'ENTER THE SCALE FACTOR FOR THE TOTAL'/
     &7X,'INSTALLATION DRAG: ',$)
      READ(5,6786,ERR=7480) SFINSP
      IF((SFINSP.LT.0.0).OR.(SFINSP.GT.2.0)) GOTO 7480
      GOTO 7400
 7490 WRITE(6,7495)
 7495 FORMAT(/7X,'ENTER THE SCALE FACTOR FOR THE NOZZLE'/
     &7X,'INTERFERENCE DRAG: ',$)
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      READ(5,6786,ERR=7490) SFIP
      IF((SFIP.LT.0.0).OR.(SFIP.GT.2.0)) GOTO 7490
      GOTO 7400
C -----------------------------------------------------------------
C --- PROPULSION PAGE 7
C -----------------------------------------------------------------
 7510 STATUS = LIB$SPAWN('CLS')
      WRITE(6,7515) (ALTD(I),I=1,6), (XMACH(I),I=1,6), NAB, KODE,
     &KT5, KT7, NOZZ
 7515 FORMAT(/
     &7X,'** PROPULSION PAGE 7 **'//
     &7X,'(1) ALTITUDES FOR DETAILED OUTPUT (FT): ',2(F7.1,',')/
     &11X,3(F7.1,','),F7.1//
     &7X,'(2) MACH NUMBERS FOR DETAILED OUTPUT: ',2(F6.3,',')/
     &11X,3(F6.3,','),F6.3//
     &7X,'(3) NUMBER OF ALT/MACH COMBINATIONS WITHOUT AB LIT..',I2/
     &7X,'(4) ENGINE TYPE INDICATOR............................',I1/
     &7X,'     (0 = TURBOJET, 2 = TURBOFAN)'/
     &7X,'(5) AFTERBURNER INDICATOR..........................',I2/
     &7X,'(6) DUCTBURNER INDICATOR...........................',I2/
     &7X,'(7) NOZZLE TYPE INDICATOR...........................',I1/
     &/'        SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,6606,ERR=7510) NUM
      IF(NUM.EQ.0) GOTO 7600
      GOTO (7530, 7540, 7550, 7560, 7570, 7580, 7590) ,NUM
      GOTO 7510
 7530 WRITE(6,7535)
 7535 FORMAT(/7X,'ENTER THE ARRAY OF ALTITUDES FOR THE DETAILED'/
     &7X,'OUTPUT (UP TO 6). PUT A ",' BETWEEN EACH NUMBER. '/
     &1X,'ALTITUDES: ',$)
      READ(5,7536,ERR=7530) (ALTD(I),I=1,6)
 7536 FORMAT(6F8.1)
      DO 7537 I=1,6
        IF((ALTD(I).LT.0.0).OR.(ALTD(I).GT.99999.0)) GOTO 7530
 7537 CONTINUE
      GOTO 7510
 7540 WRITE(6,7545)
 7545 FORMAT(/7X,'ENTER THE ARRAY OF MACH NUMBERS FOR THE DETAILED'/
     &7X,'OUTPUT (UP TO 6). THESE SHOULD BE MATCHED TO THE'/
     &7X,'ALTITUDES. PUT A ",' BETWEEN EACH NUMBER. '/
     &1X,'MACH: ',$)
      READ(5,7546,ERR=7540) (XMACH(I),I=1,6)
 7546 FORMAT(6F6.3)
      DO 7547 I=1,6
        IF((XMACH(I).LT.0.0).OR.(XMACH(I).GT.3.0)) GOTO 7540
 7547 CONTINUE
      GOTO 7510
 7550 WRITE(6,7555)
 7555 FORMAT(/7X,'ENTER THE NUMBER OF ALTITUDE/MACH NUMBER'/
     &7X,'COMBINATIONS IN THE ARRAYS ABOVE THAT DO NOT HAVE THE'/
     &7X,'AFTERBURNER/DUCTBURNER LIT. (IF THERE ARE 4 ALT/MACH'/
     &7X,'COMBINATIONS AND "3" IS ENTERED HERE, THEN THE LAST'/
     &7X,'COMBINATION WILL HAVE A LIT BURNER): ',$)
      READ(5,6606,ERR=7550) NAB
      IF((NAB.GT.6).OR.(NAB.LT.0)) GOTO 7550
      GOTO 7510
 7560 WRITE(6,7565)
 7565 FORMAT(/7X,'ENTER THE ENGINE TYPE INDICATOR'/
     &7X,'0 = TURBOJET'/
     &7X,'2 = TURBOFAN: ',$)
```

```
      READ(5,6606,ERR=7560) KODE
      IF((KODE.NE.0).AND.(KODE.NE.2)) GOTO 7560
      GOTO 7510
7570 WRITE(6,7575)
7575 FORMAT(/7X,'ENTER THE AFTERBURNER INDICATOR'/
    &7X,' 0 = NO AB'/
    &7X,'-1 = AB PRESENT, NOT LIT'/
    &7X,' 2 = AB LIT: ',$)
      READ(5,7136,ERR=7570) KT5
      IF((KT5.NE.0).AND.(KT5.NE.-1).AND.(KT5.NE.2)) GOTO 7570
      GOTO 7510
7580 WRITE(6,7585)
7585 FORMAT(/7X,'ENTER THE DUCTBURNER INDICATOR'/
    &7X,' 0 = NO DUCTBURNER'/
    &7X,'-1 = DB PRESENT, NOT LIT'/
    &7X,' 2 = DUCTBURNER LIT: ',$)
      READ(5,7136,ERR=7580) KT7
      IF((KT7.NE.0).AND.(KT7.NE.-1).AND.(KT7.NE.2)) GOTO 7580
      GOTO 7510
7590 WRITE(6,7595)
7595 FORMAT(/7X,'ENTER THE NOZZLE TYPE INDICATOR'/
    &7X,'0 = CONVERGENT NOZZLE'/
    &7X,'1 = CONVERGENT-DIVERGENT NOZZLE'/
    &7X,'2 = NOZZLE VELOCITY COEFFICIENT: ',$)
      READ(5,6606,ERR=7590) NOZZ
      IF((NOZZ.LT.0).OR.(NOZZ.GT.2)) GOTO 7590
      GOTO 7510
7600 WRITE(7,7605) ITYPE, AENDIA, AENLE, AENWT, ATURB,
    &BA, DIA1, FRBT, FRPN, HTR, HVF, PCDFAC, PWCC, RDIAM, RLENG,
    &SM1, SODG, VC1, WCWA1, YREN, ESF, TWAB, TWOAB, TWTO, EAB1,
    &EB1, ED1, ETAC1, ETAF1, ETAT1, PRFD, P11P1, P2P1, R32, R54,
    &R54N, R711, R711N, SCPR, DELT57, T3, T51, T71, DELPR, R10A,
    &MACH1, MACH2, SFBTP, SFINSP, SFIP, SFSFC1, SFSFC2, SFSFC3,
    &(ALTD(I),I=1,6), (XMACH(I),I=1,6), DEPWCC, EN, IPR, KODE,
    &KT5, KT7, NOZZ, NPUSE, IPLOT, IPRINT, KERROR, MINPR, MODPRT,
    &NAB, NDTAIL, NSUMM, ALTI, AM, POSA, TOSA
7605 FORMAT('*** PROPULSION DATA ***'/I1/' $LEWIS'/
    &5X,'AENDIA=',F7.3,',','AENLE=',F7.3,',',1X,'AENWT=',F8.2,','/
    &20X,'ATURB=',F6.3,',',2X,'BA=',F6.3,','/     !ARERTO TAKEN OUT
    &5X,'DIA1=',F6.3,',',3X,'FRBT=',F6.3,',',3X,'FRPN=',F6.3,','/
    &5X,'HTR=',F6.3,',',4X,'HVF=',F10.2,',','PCDFAC=',F6.3,','/
    &5X,'PWCC=',F7.3,',',2X,'RDIAM=',F6.3,',',2X,'RLENG=',F6.3,','/
    &5X,'SM1=',F6.3,',',4X,'SODG=',F6.3,',',3X,'VC1=',F6.3,','/
    &5X,'WCWA1=',F6.3,',',2X,'YREN=',F5.2,',',4X,'ESF=',F5.2,','/
    &5X,'TWAB=',F8.1,',',1X,'TWOAB=',F8.1,',','TWTO=',F5.2,','/
    &5X,'EAB1=',F5.3,',',4X,'EB1=',F5.3,',',5X,'ED1=',F5.3,','/
    &5X,'ETAC1=',F5.3,',',3X,'ETAF1=',F5.3,',',3X,'ETAT1=',F5.3,','/
    &5X,'PRFD=',F6.3,',',3X,'P11P1=',F6.3,',',2X,'P2P1=',F6.3,','/
    &5X,'R32=',F6.3,',',4X,'R54=',F6.3,',',4X,'R54N=',F6.3,','/
    &5X,'R711=',F6.3,',',3X,'R711N=',F6.3,',',2X,'SCPR=',F6.3,','/
    &5X,'DELT57=',F7.2,',','T3=',F8.2,',',3X,'T51=',F8.2,','/
    &5X,'T71=',F8.2,',',2X,'DELPR=',F7.2,',',1X,'R10A=',F4.1,','/
    &5X,'MACH1=',F6.3,',',2X,'MACH2=',F6.3,',',2X,'SFBTP=',F6.3,','/
    &5X,'SFINSP=',F6.3,',',1X,'SFIP=',F6.3,',',3X,'SFSFC1=',F6.3,','/
    &5X,'SFSFC2=',F6.3,',',1X,'SFSFC3=',F6.3,','/
    &5X,'ALTD=',5(F7.1,','),F7.1/5X,'XMACH=',5(F6.3,','),F6.3/
    &5X,'DEPWCC=',F6.3,',',1X,'EN=',I2,',',9X,'IPR=',I2,','/
    &5X,'KODE=',I1,',',8X,'KT5=',I2,',',8X,'KT7=',I2,','/
    &5X,'NOZZ=',I1,',',8X,'NPUSE=',I1,',',7X,'IPLOT=',I1,','/
    &5X,'IPRINT=',I1,',',6X,'KERROR=',I1,',',6X,'MINPR=',I1,','/
```

```
     &5X,'MODPRT=',I1,',',6X,'NAB=',I1,',',9X,'NDTAIL=',I2,','/
     &5X,'NSUMM=',I2,',',6X,'ALTI=',F3.1,',',6X,'AM=',F3.1,','/
     &5X,'POSA=',F5.2,',',4X,'TOSA=',F5.1,','/5X,'$END')
      RETURN
      END
C ------------------------------------------------------------------
C --- ENGINE DEFAULTS
C ------------------------------------------------------------------
      SUBROUTINE LEWIS(ITYPE, AENDIA, AENLE, AENWT, ARERTO, ATURB,
     &BA, DIA1, FRBT, FRPN, HTR, HVF, PCDFAC, PWCC, RDIAM, RLENG,
     &SM1, SODG, VC1, WCWA1, YREN, ESF, TWAB, TWOAB, TWTO, EAB1,
     &EB1, ED1, ETAC1, ETAF1, ETAT1, PRFD, P11P1, P2P1, R32, R54,
     &R54N, R711, R711N, SCPR, DELT57, T3, T51, T71, DELPR, R10A,
     &MACH1, MACH2, SFBTP, SFINSP, SFIP, SFSFC1, SFSFC2, SFSFC3,
     &ALTD, XMACH, DEPWCC, EN, IPR, KODE, KT5, KT7, NOZZ, NPUSE,
     &IPLOT, IPRINT, KERROR, MINPR, MODPRT, NAB, NDTAIL, NSUMM, ALTI,
     &AM, POSA, TOSA)
C
      INTEGER EN
      REAL MACH1, MACH2
      AENDIA=0.0
      AENLE=0.0
      AENWT=0.0
      ARERTO=1.0
      ATURB=0.242
      BA=0.0
      DIA1=1.365
      FRBT=0.0
      FRPN=0.0
      HTR=0.6
      HVF=18600.0
      PCDFAC=1.0
      PWCC=100.0
      RDIAM=1.15
      RLENG=2.0
      SM1=0.6
      SODG=1.0
      VC1=0.98
      WCWA1=0.0
      YREN=64.0
      ESF=1.0
      TWAB=0.0
      TWOAB=0.0
      TWTO=0.5
      EAB1=0.75
      EB1=0.87
      ED1=0.75
      ETAC1=0.8
      ETAF1=0.82
      ETAT1=0.9
      PRFD=1.0
      P11P1=1.0
      P2P1=7.0
      R32=0.95
      R54=0.94
      R54N=0.94
      R711=0.98
      R711N=0.82
      SCPR=1.27
      DELT57=100.0
```

```
T3=2160.0
T51=0.0
T71=0.0
DELPR=0.0
R10A=-1.0
MACH1=1.0
MACH2=1.1
SFBTP=0.0
SFINSP=0.0
SFIP=0.0
SFSFC1=1.0
SFSFC2=1.0
SFSFC3=1.0
ALTD=0.0
DEPWCC=2.0
XMACH=0.0
EN=2
IPR=3
KODE=0
KT5=-1
KT7=0
NOZZ=1
NPUSE=2
IPLOT=0
IPRINT=0
KERROR=0
MINPR=1
MODPRT=4
NAB=6
NDTAIL=0
NSUMM=15
ALTI=0.0
AM=0.0
POSA=29.92
TOSA=518.0
IF(ITYPE.EQ.1) THEN                     ! SET J85 DEFAULTS
  AENDIA=1.365
  AENLE=9.16
  AENWT=608.0
  ATURB=0.242
  BA=0.0
  DIA1=1.365
  EB1=0.87
  ETAC1=0.8
  HTR=0.6
  PRFD=1.0
  P11P1=1.0
  P2P1=7.0
  R10A=-1.0
  R32=0.95
  R54N=0.94
  SCPR=1.27
  SM1=0.6
  TWAB=4080.0
  TWOAB=2720.0
  T3=2160.0
  WCWA1=0.0
  YREN=63.0
  AENLE=9.16
  AENWT=608.0
```

```
    KODE=0
    KT5=-1
    NOZZ=1
  ENDIF
  IF(ITYPE.EQ.2) THEN           ! SET TF30 DEFAULTS
    AENDIA=3.8
    AENLE=15.18
    AENWT=3790.0
    ATURB=0.328
    BA=0.73
    DIA1=3.8
    EB1=0.94
    ETAC1=0.8
    HTR=0.6
    PRFD=2.43
    P11P1=7.41
    P2P1=21.8
    R54=0.92
    R54N=0.88
    SCPR=1.21
    TWAB=25100.0
    TWOAB=14560.0
    T3=2743.0
    WCWA1=0.018
    YREN=71.0
    AENLE=15.18
    AENWT=3790.0
    KT5=2
    KT7=2
    NOZZ=1
  ENDIF
  IF(ITYPE.EQ.3) THEN           ! SET JT8D DEFAULTS
    AENDIA=3.66
    AENLE=10.31
    AENWT=3218.0
    ATURB=0.411
    BA=1.03
    DIA1=3.655
    EB1=0.94
    ETAC1=0.82
    HTR=0.4
    PRFD=1.91
    P11P1=4.2
    P2P1=16.9
    R32=0.95
    R54=0.96
    R54N=0.98
    SCPR=1.2
    TWAB=0.0
    TWOAB=14500.0
    T3=2180.0
    WCWA1=0.0
    YREN=68.0
    AENLE=10.31
    AENWT=3218.0
  ENDIF
  IF(ITYPE.EQ.4) THEN           !SET JT9D DEFAULTS
    AENLE=14.08
    AENWT=8874.0
    ATURB=0.385
```

```
  BA=8.2
  EB1=0.98
  ETAC1=0.82
  ETAT1=0.92
  HTR=0.3
  PRFD=1.6
  P11P1=1.6
  P2P1=22.9
  R54N=0.96
  SCPR=1.2
  TWAB=0.0
  TWOAB=50000.0
  T3=2835.0
  WCWA1=0.02
  YREN=70.0
  AENLE=14.08
  AENWT=8874.0
ENDIF
IF(ITYPE.EQ.5) THEN       !SET CF6 DEFAULTS
  AENDIA=8.2
  AENLE=14.86
  AENWT=9767.0
  ATURB=0.385
  BA=4.4
  DIA1=8.2
  EB1=0.94
  ETAC1=0.82
  ETAT1=0.92
  HTR=0.3
  PRFD=1.56
  P11P1=1.72
  P2P1=30.0
  R54N=0.92
  SCPR=1.21
  TWAB=0.0
  TWOAB=50280.0
  T3=2800.0
  WCWA1=0.02
  YREN=70.0
  AENLE=14.86
  AENWT=9767.0
ENDIF
IF(ITYPE.EQ.6) THEN       !SET GENERIC DEFAULTS
  AENDIA=8.2
  AENLE=8.67
  AENWT=1421.0
  ATURB=0.385
  BA=6.23
  DIA1=8.2
  EAB1=0.75
  EB1=0.87
  ED1=0.75
  ETAC1=0.8
  ETAF1=0.9
  ETAT1=0.92
  HTR=0.6
  PRFD=1.51
  PWCC=100.0
  P11P1=1.396
  P2P1=20.1
```

```
        R10A=-1.0
        R32=0.97
        R54=0.98
        R54N=0.98
        R711=0.98
        R711N=.98
        SCPR=1.21
        SM1=0.5
        TWAB=0.0
        TWOAB=9300.0
        T3=2637.0
        T51=3400.0
        T71=3400.0
        VC1=0.98
        WCWA1=0.0
        YREN=70.0
        KODE=2
        KT5=0
        KT7=0
        NOZZ=0
      ENDIF
      RETURN
      END
C ------------------------------------------------------------------------
      SUBROUTINE WEIGHTS (DVFLAG, ATYPE)
C    <><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>
C --- WEIGHTS
C    <><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><><>
      LOGICAL DVFLAG
      CHARACTER ANS*6, TITLE*80, ATYPE*10
      DIMENSION SLOPE(17)
      REAL KP1, KP2, K1, K2, K3, K4, K5
 7650 IF(DVFLAG.EQ..FALSE.) THEN
 7660   STATUS = LIB$SPAWN('CLS')
        WRITE(6,7665)
 7665   FORMAT(//
     &  7X,'DO YOU WANT TO MAKE ANY CHANGES TO THE WEIGHTS'/
     &  7X,'MODULE?'//7X,'(1) YES'/7X,'(2) NO'//
     &  7X,'SELECT 1 OR 2: ',$)
        READ(5,7666,ERR=7660) NUM
 7666   FORMAT(I1)
        IF(NUM.EQ.1) GOTO 7750
        IF(NUM.NE.2) GOTO 7660
C ---   TRANSFER THE $OPTS AND $FIXW NAMELISTS FROM (10) TO (7)
        REWIND(10)
 7680   READ(10,7681) ANS
 7681   FORMAT(A6)
        IF(ANS.NE.'*** WE') GOTO 7680
 7690   WRITE(7,7695) ATYPE       ! AIRCRAFT TYPE ABOVE WEIGHTS TITLE
 7695   FORMAT(A10)
        WRITE(7,7705)
 7705   FORMAT('*** WEIGHTS DATA ***')
        DO 7730 I=1,22
           READ(10,7708) TITLE
 7708      FORMAT(A80)
           WRITE(7,7708) TITLE
 7730   CONTINUE
        RETURN
      ENDIF
 7750 IF(DVFLAG.EQ..FALSE.) THEN
```

```
      REWIND(10)
 7760 READ(10,7681) ANS
      IF(ANS.NE.'*** WE') GOTO 7760
      READ(10,7770) FR, KP1, KP2, SLOPE(1), SLOPE(2), SLOPE(3),
     & SLOPE(4), SLOPE(5), SLOPE(6), SLOPE(7), SLOPE(8), SLOPE(9),
     & SLOPE(10), SLOPE(11), SLOPE(12), SLOPE(13), SLOPE(14),
     & SLOPE(15), SLOPE(16), SLOPE(17), TECHG, DENS, WGTO, AFMACH,
     & K1, K2, K3, K4, K5, STRESS, IDELT, IOBLIQ, IPRINT, ITAIL,
     & KBODY, KERROR, KWING, WPL, WAMMUN, WBOMB, WMISS, WETANK
 7770 FORMAT(/8X,F6.3,10X,F6.3,9X,F6.3/14X,F6.3,19X,F6.3/
     & 14X,F6.3,19X,F6.3/14X,F6.3,19X,F6.3/14X,F6.3,19X,F6.3/
     & 14X,F6.3,20X,F6.3/15X,F6.3,19X,F6.3/15X,F6.3,19X,F6.3/
     & 15X,F6.3,19X,F6.3/15X,F6.3/11X,F6.3,8X,F6.3,9X,F8.1/
     & 12X,F6.3,5X,F6.3,9X,F6.3/8X,F6.3,9X,F6.3,9X,F6.3/
     & 12X,F8.1,21X,I1/12X,I1,14X,I1,13X,I1/11X,I1,15X,I1,13X,I1///
     & 9X,F8.1,10X,F7.1,7X,F8.1/11X,F8.1,8X,F7.1)
     ENDIF
     IF(DVFLAG.EQ..TRUE.) THEN         ! SET DEFAULTS
       CALL WGHT(FR, KP1, KP2, SLOPE, TECHG, DENS, WGTO, AFMACH,
     & K1, K2, K3, K4, K5, STRESS, IDELT, IOBLIQ, IPRINT, ITAIL,
     & KBODY, KERROR, KWING, WPL, ATYPE, WAMMUN, WBOMB, WMISS,
     & WETANK)
     ENDIF
C ------------------------------------------------------------------
C --- WEIGHTS PAGE 1
C ------------------------------------------------------------------
 7800 STATUS = LIB$SPAWN('CLS')
     WRITE(6,7805) (SLOPE(I),I=1,9)
 7805 FORMAT(/
    &7X,'** WEIGHTS PAGE 1 **'//
    &7X,'(1) WING SLOPE.........................',F6.3/
    &7X,'(2) FUSELAGE SLOPE.....................',F6.3/
    &7X,'(3) HORIZONTAL TAIL/CANARD SLOPE.......',F6.3/
    &7X,'(4) VERTICAL TAIL SLOPE................',F6.3/
    &7X,'(5) NACELLES SLOPE.....................',F6.3/
    &7X,'(6) LANDING GEAR SLOPE.................',F6.3/
    &7X,'(7) ENGINES SLOPE......................',F6.3/
    &7X,'(8) FUEL SYSTEM SLOPE..................',F6.3/
    &7X,'(9) HYDRAULICS/PNEUMATICS SLOPE........',F6.3//
    &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
     READ(5,7666,ERR=7800) NUM
     IF(NUM.EQ.0) GOTO 7920
     GOTO (7820, 7830, 7840, 7850, 7860, 7870, 7880, 7890, 7900) ,NUM
     GOTO 7800
 7820 WRITE(6,7825)
 7825 FORMAT(/7X,'ENTER THE WING WEIGHT SLOPE: ',$)
     READ(5,7826,ERR=7820) SLOPE(1)
 7826 FORMAT(F6.3)
     IF((SLOPE(1).LT.0.0).OR.(SLOPE(1).GT.3.0)) GOTO 7820
     GOTO 7800
 7830 WRITE(6,7835)
 7835 FORMAT(/7X,'ENTER THE FUSELAGE WEIGHT SLOPE: ',$)
     READ(5,7826,ERR=7830) SLOPE(2)
     IF((SLOPE(2).LT.0.0).OR.(SLOPE(2).GT.3.0)) GOTO 7830
     GOTO 7800
 7840 WRITE(6,7845)
 7845 FORMAT(/7X,'ENTER THE HORIZONTAL TAIL/CANARD'/
    &7X,'WEIGHT SLOPE: ',$)
     READ(5,7826,ERR=7840) SLOPE(3)
     IF((SLOPE(3).LT.0.0).OR.(SLOPE(3).GT.3.0)) GOTO 7840
```

```
      GOTO 7800
 7850 WRITE(6,7855)
 7855 FORMAT(/7X,'ENTER THE VERTICAL TAIL WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7850) SLOPE(4)
      IF((SLOPE(4).LT.0.0).OR.(SLOPE(4).GT.3.0)) GOTO 7850
      GOTO 7800
 7860 WRITE(6,7865)
 7865 FORMAT(/7X,'ENTER THE NACELLES WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7860) SLOPE(5)
      IF((SLOPE(5).LT.0.0).OR.(SLOPE(5).GT.3.0)) GOTO 7860
      GOTO 7800
 7870 WRITE(6,7875)
 7875 FORMAT(/7X,'ENTER THE LANDING GEAR WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7870) SLOPE(6)
      IF((SLOPE(6).LT.0.0).OR.(SLOPE(6).GT.3.0)) GOTO 7870
      GOTO 7800
 7880 WRITE(6,7885)
 7885 FORMAT(/7X,'ENTER THE ENGINES WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7880) SLOPE(7)
      IF((SLOPE(7).LT.0.0).OR.(SLOPE(7).GT.3.0)) GOTO 7880
      GOTO 7800
 7890 WRITE(6,7895)
 7895 FORMAT(/7X,'ENTER THE FUEL SYSTEM WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7890) SLOPE(8)
      IF((SLOPE(8).LT.0.0).OR.(SLOPE(8).GT.3.0)) GOTO 7890
      GOTO 7800
 7900 WRITE(6,7905)
 7905 FORMAT(/7X,'ENTER THE HYDRAULICS/PNEUMATICS WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7900) SLOPE(9)
      IF((SLOPE(9).LT.0.0).OR.(SLOPE(9).GT.3.0)) GOTO 7900
      GOTO 7800
C ------------------------------------------------------------------
C --- WEIGHTS PAGE 2
C ------------------------------------------------------------------
 7920 STATUS = LIB$SPAWN('CLS')
      WRITE(6,7925) (SLOPE(I),I=10,17), WPL
 7925 FORMAT(/
     &7X,'** WEIGHTS PAGE 2 **'//
     &7X,'(1) ELECTRICAL SYSTEM SLOPE...........',F6.3/
     &7X,'(2) AVIONICS SLOPE....................',F6.3/
     &7X,'(3) INSTRUMENTATION SLOPE.............',F6.3/
     &7X,'(4) ENVIRONMENTAL SYSTEM SLOPE........',F6.3/
     &7X,'(5) PASSENGER ACCOMODATIONS SLOPE.....',F6.3/
     &7X,'(6) AUXILIARY POWER UNIT SLOPE........',F6.3/
     &7X,'(7) FLIGHT CONTROLS SLOPE.............',F6.3/
     &7X,'(8) CREW ACCOMODATIONS SLOPE..........',F6.3/
     &7X,'(9) PAYLOAD WEIGHT (LBS)..........',F8.1//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,7666,ERR=7920) NUM
      IF(NUM.EQ.0) GOTO 8030
      GOTO (7940, 7950, 7960, 7970, 7980, 7990, 8000, 8010, 8020) ,NUM
      GOTO 7920
 7940 WRITE(6,7945)
 7945 FORMAT(/7X,'ENTER THE ELECTRICAL SYSTEM WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7940) SLOPE(10)
      IF((SLOPE(10).LT.0.0).OR.(SLOPE(10).GT.3.0)) GOTO 7940
      GOTO 7920
 7950 WRITE(6,7955)
 7955 FORMAT(/7X,'ENTER THE AVIONICS WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7950) SLOPE(11)
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      IF((SLOPE(11).LT.0.0).OR.(SLOPE(11).GT.3.0)) GOTO 7950
      GOTO 7920
 7960 WRITE(6,7965)
 7965 FORMAT(/7X,'ENTER THE INSTRUMENTATION WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7960) SLOPE(12)
      IF((SLOPE(12).LT.0.0).OR.(SLOPE(12).GT.3.0)) GOTO 7960
      GOTO 7920
 7970 WRITE(6,7975)
 7975 FORMAT(/7X,'ENTER THE ENVIRONMENTAL SYSTEM WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7970) SLOPE(13)
      IF((SLOPE(13).LT.0.0).OR.(SLOPE(13).GT.3.0)) GOTO 7970
      GOTO 7920
 7980 WRITE(6,7985)
 7985 FORMAT(/7X,'ENTER THE PASSENGER ACCOMODATIONS'/
     &7X,'WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7980) SLOPE(14)
      IF((SLOPE(14).LT.0.0).OR.(SLOPE(14).GT.3.0)) GOTO 7980
      GOTO 7920
 7990 WRITE(6,7995)
 7995 FORMAT(/7X,'ENTER THE AUXILIARY POWER UNIT WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=7990) SLOPE(15)
      IF((SLOPE(15).LT.0.0).OR.(SLOPE(15).GT.3.0)) GOTO 7990
      GOTO 7920
 8000 WRITE(6,8005)
 8005 FORMAT(/7X,'ENTER THE FLIGHT CONTROLS WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=8000) SLOPE(16)
      IF((SLOPE(16).LT.0.0).OR.(SLOPE(16).GT.3.0)) GOTO 8000
      GOTO 7920
 8010 WRITE(6,8015)
 8015 FORMAT(/7X,'ENTER THE CREW ACCOMODATIONS WEIGHT SLOPE: ',$)
      READ(5,7826,ERR=8010) SLOPE(17)
      IF((SLOPE(17).LT.0.0).OR.(SLOPE(17).GT.3.0)) GOTO 8010
      GOTO 7920
 8020 WRITE(6,8025)
 8025 FORMAT(/7X,'ENTER THE TOTAL PAYLOAD WEIGHT (LBS). (THIS'/
     &7X,'SHOULD INCLUDE ALL AMMUNITION, ARMAMENT, MISSILES,'/
     &7X,'BOMBS, PASSENGERS ETC...): ',$)
      READ(5,8026,ERR=8020) WPL
 8026 FORMAT(F8.1)
      IF(WPL.LT.0.0) GOTO 8020
      GOTO 7920
C -------------------------------------------------------------------
C --- WEIGHTS PAGE 3
C -------------------------------------------------------------------
 8030 STATUS = LIB$SPAWN('CLS')
      WRITE(6,8035) KP1, KP2, AFMACH, DENS, STRESS, IDELT, IOBLIQ,
     &ITAIL, KBODY, KWING, WGTO
 8035 FORMAT(/
     &7X,'** WEIGHTS PAGE 3 **'//
     &7X,'(1)  WING PIVOT FACTOR...........................',F6.3/
     &7X,'(2)  EXTERNAL TANK FACTOR........................',F6.3/
     &7X,'(3)  MAXIMUM MACH NUMBER.........................',F6.3/
     &7X,'      (TRANSPORTS/BOMBERS ONLY)'/
     &7X,'(4)  OBLIQUE WING MATERIAL DENSITY (LBS/IN3).....',F6.3/
     &7X,'(5)  OBLIQUE WING ALLOWABLE STRESS (PSI).....',F8.1/
     &7X,'(6)  WING WEIGHT EQUATION........................',I1/
     &7X,'      (0 = STANDARD WING, 1 = DELTA WING)'/
     &7X,'(7)  OBLIQUE WING WEIGHT EQUATION.................',I1/
     &7X,'      (0 = STANDARD WING, 1 = OBLIQUE WING)'/
     &7X,'(8)  TAIL INDICATOR..............................',I1/
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     &7X,'       (0 = STANDARD TAIL, 1 = HIGH/T-TAIL)'/
     &7X,'(9)   BODY EQUATION (TRANSPORTS/BOMBERS)...........',I1/
     &7X,'       (1 = SANDERS, 2 = AIR FORCE)'/
     &7X,'(10) WING WEIGHT TECHNIQUE (TRANSPORTS/BOMBERS)...',I1/
     &7X,'       (1 = SANDERS, 2 = AIR FORCE, 3 = LANGLY)'/
     &7X,'(11) ESTIMATE OF TAKEOOFF GROSS WEIGHT.......',F8.1//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,8036,ERR=8030) NUM
8036 FORMAT(I2)
      IF(NUM.EQ.0) GOTO 8160
      GOTO (8050, 8060, 8070, 8080, 8090, 8100, 8110, 8120, 8130,
     &8140, 8150) ,NUM
      GOTO 8030
8050 WRITE(6,8055)
8055 FORMAT(/7X,'ENTER THE WING PIVOT FACTOR (1.0 = STANDARD'/
     &7X,'WING PIVOT WEIGHT): ',$)
      READ(5,7826,ERR=8050) KP1
      IF((KP1.LT.0.0).OR.(KP1.GT.3.0)) GOTO 8050
      GOTO 8030
8060 WRITE(6,8065)
8065 FORMAT(/7X,'ENTER THE EXTERNAL FUEL TANK FACTOR'/
     &7X,'(1.0 = STANDARD METAL TANKS): ',$)
      READ(5,7826,ERR=8060) KP2
      IF((KP2.LT.0.0).OR.(KP2.GT.3.0)) GOTO 8060
      GOTO 8030
8070 WRITE(6,8075)
8075 FORMAT(/7X,'ENTER THE MAXIMUM ALLOWABLE MACH NUMBER (FOR'/
     &7X,'TRANSPORTS AND BOMBERS ONLY): ',$)
      READ(5,7826,ERR=8070) AFMACH
      IF((AFMACH.LT.0.0).OR.(AFMACH.GT.3.0)) GOTO 8070
      GOTO 8030
8080 WRITE(6,8085)
8085 FORMAT(/7X,'ENTER THE MATERIAL DENSITY OF THE OBLIQUE WING'/
     &7x,'(LBS/IN3): ',$)
      READ(5,7826,ERR=8080) DENS
      IF((DENS.LT.0.0).OR.(DENS.GT.1.0)) GOTO 8080
      GOTO 8030
8090 WRITE(6,8095)
8095 FORMAT(/7X,'ENTER THE ALLOWABLE STRESS IN THE OBLIQUE WING: '
     &,$)
      READ(5,8026,ERR=8090) STRESS
      IF((STRESS.LT.5000.0).OR.(STRESS.GT.100000.0)) GOTO 8090
      GOTO 8030
8100 WRITE(6,8105)
8105 FORMAT(/7X,'ENTER THE WING EQUATION TO USE.'/
     &7X,'(0 = STANDARD WING, 1 = DELTA WING): ',$)
      READ(5,7666,ERR=8100) IDELT
      IF((IDELT.NE.0).AND.(IDELT.NE.1)) GOTO 8100
      GOTO 8030
8110 WRITE(6,8115)
8115 FORMAT(/7X,'ENTER THE OBLIQUE WING EQUATION TO USE.'/
     &7X,'(0 = STANDARD WING, 1 = OBLIQUE WING): ',$)
      READ(5,7666,ERR=8110) IOBLIQ
      IF((IOBLIQ.NE.0).AND.(IOBLIQ.NE.1)) GOTO 8110
      GOTO 8030
8120 WRITE(6,8125)
8125 FORMAT(/7X,'ENTER THE TAIL TYPE TO USE.'/
     &7X,'(0 = STANDARD TAIL, 1 = HIGH TAIL OR T-TAIL): ',$)
      READ(5,7666,ERR=8120) ITAIL
      IF((ITAIL.NE.0).AND.(ITAIL.NE.1)) GOTO 8120
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      GOTO 8030
 8130 WRITE(6,8135)
 8135 FORMAT(/7X,'ENTER THE BODY EQUATION TO USE.'/
     &7X,'(1 = SANDERS, 2 = AIRFORCE): ',$)
      READ(5,7666,ERR=8130) KBODY
      IF((KBODY.NE.1).AND.(KBODY.NE.2)) GOTO 8130
      GOTO 8030
 8140 WRITE(6,8145)
 8145 FORMAT(/7X,'ENTER THE WING EQUATION TECHNIQUE TO USE.'/
     &7X,'(1 = SANDERS, 2 = AIR FORCE, 3 = LANGLY): ',$)
      READ(5,7666,ERR=8100) KWING
      IF((KWING.LT.1).OR.(KWING.GT.3)) GOTO 8140
      GOTO 8030
 8150 WRITE(6,8155)
 8155 FORMAT(/7X,'ENTER AN ESTIMATE FOR THE TAKEOFF GROSS'/
     &7X,' WEIGHT (LBS): ',$)
      READ(5,8026,ERR=8150) WGTO
      IF(WGTO.LE.0.0) GOTO 8150
      GOTO 8030
C -----------------------------------------------------------------------
C --- WEIGHTS PAGE 4
C -----------------------------------------------------------------------
 8160 STATUS = LIB$SPAWN('CLS')
      WRITE(6,8161) WAMMUN, WBOMB, WMISS, WETANK
 8161 FORMAT(/7X,'** WEIGHTS PAGE 4 **'//
     &7X,'(1) WEIGHT OF THE AMMUNITION (LBS)...',F7.1/
     &7X,'(2) WEIGHT OF THE BOMBS.............',F8.1/
     &7X,'(3) WEIGHT OF THE MISSILES..........',F8.1/
     &7X,'(4) WEIGHT OF THE EXTERNAL TANKS.....',F7.1//
     &7X,'SELECT A VALUE TO CHANGE OR 0 TO CONTINUE: ',$)
      READ(5,7666,ERR=8160) NUM
      IF(NUM.EQ.0) GOTO 8300
      GOTO (8170, 8180, 8190, 8200) ,NUM
      GOTO 8160
 8170 WRITE(6,8175)
 8175 FORMAT(/7X,'ENTER THE WEIGHT OF THE AMMUNITION: ',$)
      READ(5,8176,ERR=8170) WAMMUN
 8176 FORMAT(F7.1)
      IF(WAMMUN.LT.0.0) GOTO 8170
      GOTO 8160
 8180 WRITE(6,8185)
 8185 FORMAT(/7X,'ENTER THE WEIGHT OF THE BOMBS: ',$)
      READ(5,8026,ERR=8180) WBOMB
      IF(WBOMB.LT.0.0) GOTO 8180
      GOTO 8160
 8190 WRITE(6,8195)
 8195 FORMAT(/7X,'ENTER THE WEIGHT OF THE MISSILES: ',$)
      READ(5,8026,ERR=8190) WMISS
      IF(WMISS.LT.0.0) GOTO 8190
      GOTO 8160
 8200 WRITE(6,8205)
 8205 FORMAT(/7X,'ENTER THE WEIGHT OF THE EXTERNAL TANKS: ',$)
      READ(5,8176,ERR=8200) WETANK
      IF(WETANK LT.0.0) GOTO 8200
      GOTO 8160
 8300 WRITE(7,8365) ATYPE, FR, KP1, KP2, SLOPE(1), SLOPE(2), SLOPE(3),
     &SLOPE(4), SLOPE(5), SLOPE(6), SLOPE(7), SLOPE(8), SLOPE(9),
     &SLOPE(10), SLOPE(11), SLOPE(12), SLOPE(13), SLOPE(14),
     &SLOPE(15), SLOPE(16), SLOPE(17), TECHG, DENS, WGTO, AFMACH,
     &K1, K2, K3, K4, K5, STRESS, IDELT, IOBLIQ, IPRINT, ITAIL,
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     &KBODY, KERROR, KWING, WPL, WAMMUN, WBOMB, WMISS, WETANK
 8365 FORMAT(A10/'*** WEIGHTS DATA ***'/' $OPTS'/
     &5X,'FR=',F6.3,',',5X,'KP1=',F6.3,',',4X,'KP2=',F6.3,','/
     &5X,'SLOPE(1)=',F6.3,',',9X,'SLOPE(2)=',F6.3,','/
     &5X,'SLOPE(3)=',F6.3,',',9X,'SLOPE(4)=',F6.3,','/
     &5X,'SLOPE(5)=',F6.3,',',9X,'SLOPE(6)=',F6.3,','/
     &5X,'SLOPE(7)=',F6.3,',',9X,'SLOPE(8)=',F6.3,','/
     &5X,'SLOPE(9)=',F6.3,',',9X,'SLOPE(10)=',F6.3,','/
     &5X,'SLOPE(11)=',F6.3,',',8X,'SLOPE(12)=',F6.3,','/
     &5X,'SLOPE(13)=',F6.3,',',8X,'SLOPE(14)=',F6.3,','/
     &5X,'SLOPE(15)=',F6.3,',',8X,'SLOPE(16)=',F6.3,','/
     &5X,'SLOPE(17)=',F6.3,','/
     &5X,'TECHG=',F6.3,',',2X,'DENS=',F6.3,',',3X,'WGTO=',F8.1,','/
     &5X,'AFMACH=',F6.3,',',1X,'K1='.F6.3,',',5X,'K2=',F6.3,','/
     &5X,'K3=',F6.3,',',5X,'K4=',F6.3,',',5X,'K5=',F6.3,','/
     &5X,'STRESS=',F8.1,',',14X,'IDELT=',I1,','/
     &5X,'IOBLIQ=',I1,',',6X,'IPRINT=',I1,',',6X,'ITAIL=',I1,','/
     &5X,'KBODY=',I1,',',7X,'KERROR=',I1,',',6X,'KWING=',I1,','/
     &5X,'$END'/' $FIXW'/
     &5X,'WPL=',F8.1,','2X,'WAMMUN=',F7.1,',','WBOMB=',F8.1,','/
     &5X,'WMISS=',F8.1,',','WETANK=',F7.1,','/
     &5X,'$END')
      RETURN
      END
C ---------------------------------------------------------------------
C --- WEIGHTS DEFAULTS
C ---------------------------------------------------------------------
      SUBROUTINE WGHT(FR, KP1, KP2, SLOPE, TECHG, DENS, WGTO, AFMACH,
     &K1, K2, K3, K4, K5, STRESS, IDELT, IOBLIQ, IPRINT, ITAIL,
     &KBODY, KERROR, KWING, WPL,ATYPE,WAMMUN, WBOMB, WMISS, WETANK)
      DIMENSION SLOPE(17)
      REAL KP1, KP2, K1, K2, K3, K4, K5
      CHARACTER ATYPE*10
      IF(ATYPE.EQ.'FIGHTER   ') FR=1.5
      IF(ATYPE.EQ.'BOMBER    ') FR=1.0
      IF(ATYPE.EQ.'TRANSPORT ') FR=1.0
      KP1=1.0
      KP2=1.0
      DO 10 I=1,17
        SLOPE(I)=1.0
   10 CONTINUE
      TECHG=1.0
      DENS=0.056
      IF(ATYPE.EQ.'FIGHTER   ') WGTO=20000
      IF(ATYPE.EQ.'BOMBER    ') WGTO=50000
      IF(ATYPE.EQ.'TRANSPORT ') WGTO=100000
      AFMACH=0.85
      K1=1.0
      K2=1.0
      K3=1.0
      K4=1.0
      K5=1.0
      STRESS=30000.0
      IDELT=0
      IOBLIQ=0
      IPRINT=1
      ITAIL=0
      KBODY=1
      KERROR=0
      KWING=1
```

```
WPL=0.0
WAMMUN=0.0
WBOMB=0.0
WMISS=0.0
WETANK=0.0
RETURN
END
```

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